California Bird Species of Special Concern

A Ranked Assessment of Species, Subspecies, and Distinct Populations of Birds of Immediate Conservation Concern in California

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In Collaboration with the Bird Species of Special Concern Technical Advisory Committee
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Studies of Western Birds No. 1

Published by

Western Field Ornithologists
Camarillo, California

and

California Department of Fish and Game
Sacramento, California

With Support From
Audubon California, BonTerra Consulting, EDAW, H. T. Harvey & Associates, Jones & Stokes, LSA Associates, The Nature Conservancy, PRBO Conservation Science, SWCA Environmental Consultants

Studies of Western Birds, a monograph series of Western Field Ornithologists, publishes original scholarly contributions to field ornithology from both professionals and amateurs that are too long for inclusion in *Western Birds*. The region of interest is the Rocky Mountain and Pacific states and provinces, including Alaska and Hawaii, western Texas, northwestern Mexico, and the northeastern Pacific Ocean. Subject matter may include studies of distribution and abundance, population dynamics, other aspects of ecology, geographic variation, systematics, life history, migration, behavior, and conservation. Submit manuscripts to the editor, Kenneth P. Able, Bob's Creek Ranch, 535-000 Little Valley Rd., McArthur, CA 96056; we highly recommend discussing potential submissions with the editor prior to manuscript preparation (email: kenable@hughes.net).

Studies of Western Birds No. 1, issued 4 February 2008, is published jointly by:

Western Field Ornithologists
c/o Western Foundation of Vertebrate Zoology
439 Calle San Pablo
Camarillo, CA 93012
www.westernfieldornithologists.org

California Department of Fish and Game
1416 Ninth Street
Sacramento, CA 95814
www.dfg.ca.gov

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Printed with soy-based ink on 60# coated matte acid-free paper in the United States by Allen Press. Paper includes 10% recycled content, the remainder from wood harvested from well-managed forests. Text set in Garamond Pro typeface.

Library of Congress Control Number: 2007937686

ISBN-13: 978-0-9790585-1-6

ISBN-10: 0-9790585-1-1

Editors: W. David Shuford and Thomas Gardali.

Project manager: Lyann A. Comrack.

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Suggested Citation:

Shuford, W. D., and Gardali, T., editors. 2008. California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

For individual species accounts, please first cite the account author(s) and the species account name followed by information on the full volume.

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Foreword

The publication of *Bird Species of Special Concern: A Ranked Assessment of Species, Subspecies, and Distinct Populations of Birds of Immediate Conservation Concern in California* marks the culmination of a synergistic collaboration among California's top field and museum ornithologists, wildlife biologists, and conservationists to produce a definitive treatment of the status of declining and vulnerable bird populations in California. Since 1978, when the Western Field Ornithologists' J. V. Remsen Jr. prepared the first report on bird species of special concern for the Department of Fish and Game, information on the state's bird populations has expanded exponentially. The current project grew out of recognition by the Department and its partners of the pressing need for a rigorous and comprehensive evaluation of this recent information. We offer this volume as a product of success in achieving that vision and believe it sets a new standard for assessing the status of bird populations in California.

Through commitment to technical excellence, this volume ties together the threads of bird conservation in California by capturing elements of the most important current bird conservation initiatives. From the habitat-based California Partners in Flight bird conservation plans to the fundamental baseline bird population studies conducted by the Department and its partners, *Bird Species of Special Concern* combines the best of our collective knowledge and stands as a testament to the enormous potential of collaboration.

In producing this monograph, the Department worked closely with PRBO Conservation Science and Western Field Ornithologists. This project would not have been completed, however, without the extraordinary dedication and participation of California's ornithological and birding communities.

The Department remains committed to a continued investment in population assessment and adaptive management as tools for effective conservation of the state's bird populations. *Bird Species of Special Concern* will focus these efforts on the varied, ongoing challenges facing at-risk birds and their habitats.

John McCamman
Acting Director
California Department of
Fish and Game

Western Field Ornithologists is proud to unveil the first volume of its new monograph series, *Studies of Western Birds*, particularly with a work dedicated to the conservation of at-risk birds within California. We hope that this will stimulate other comparable works on at-risk birds elsewhere or additional lengthy treatises on any aspect of field ornithology within the region of interest of the organization—the Rocky Mountain and Pacific states and provinces, including Alaska and Hawaii, western Texas, northwestern Mexico, and the northeastern Pacific Ocean. Western Field Ornithologists strives for excellence in its publications. Of primary concern is the advancement of the long tradition of field ornithology in this region, both for pursuit of scientific understanding and to promote conservation of the region's varied and stimulating avifauna. Such efforts, including the present publication, are possible only with the participation of our membership, readership, and many partners. We invite you to join us and we seek your insights and help to further these goals.

David Krueper
President
Western Field Ornithologists

Preface

The system used in this volume to rank the conservation needs of at-risk birds—*Bird Species of Special Concern*—in California is new for the state but builds on an impressive foundation of prior ranking schemes developed elsewhere in North America and the world. The diversity of such systems reflects not only the varying needs and scales for which they were devised but also the difficulty of crafting a system that will be universally accepted for any particular purpose. Just as gut-level impressions of what constitutes an at-risk bird in need of immediate conservation action can vary widely among knowledgeable biologists, so too can opinions of what elements are desirable in an objective ranking scheme meant to reduce the biases inherent in a purely subjective assessment of conservation need and priority. The present system, unlike most, supports the rankings by the inclusion of thorough species accounts for all birds on the ranked special concern list. Although the decision to include these accounts greatly lengthened the time required to prepare this document, we judge the extra effort well worth it, both to document the state of, and limits to, current knowledge relevant to the conservation of at-risk birds and to provide guidance in management, research, and monitoring that will enable effective actions beneficial to these birds and their habitats.

Serving as the technical editors of this volume has been a humbling experience on many levels. The knowledge contributed to this process by a technical advisory committee of our peers, dedicated managers and technical experts at California Department of Fish and Game, authors of species accounts, and a wide array of field, quantitative, and conservation biologists who provided unpublished information, insights, and thoughtful reviews has been deep and impressive, strengthening this document far beyond what our own capabilities would allow. Conversely, we have been struck by how limited our collective knowledge is for many at-risk birds in California, reflecting their biological characteristics—such as patchy distributions, occurrence in low densities, naturally fluctuating populations, or cryptic behaviors—and the limited resources allocated for their study or conservation.

During the course of the preparation of this document, climate change has become a household word and the dominant conservation issue discussed in the media. Although the present volume acknowledges the importance of the long-term effects of climate change on birds, it focuses rather on the short- and medium-term threats to birds, particularly habitat loss and degradation as the direct result of human endeavors. Such activities will continue to have readily visible and cumulatively enormous effects on many bird populations. To varying degrees, the predicted indirect effects of progressive climate change will further complicate and exacerbate matters.

Despite declining populations and continuing threats to many at-risk birds, there is cause for cautious optimism in the many new habitat- or taxonomic-based conservation initiatives for birds that have begun or expanded their reach in the last decade. In concert with these efforts, lists of at-risk species can be powerful drivers of conservation, especially when restoration and management measures take a species-to-ecosystem approach, the one typically championed by these newer initiatives. We hope this volume will support and inspire bold measures of conservation for at-risk birds and for others now less threatened so they will not one day too receive the dodoesque distinction of being of special concern in California.

W. David Shuford
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Inverness, California

Acknowledgments

The revision of California Department of Fish and Game's (CDFG) Bird Species of Special Concern list was a collaborative effort between CDFG, the Bird Species of Special Concern Technical Advisory Committee, and PRBO Conservation Science (PRBO, founded as Point Reyes Bird Observatory). We especially thank all of the members of the advisory committee for their dedication to the conservation of California's birds and for their many insights, without which this document would not have been possible. Brian Walton sadly did not live to see this work completed. Still, his contributions to the advisory committee will long be remembered, particularly his extensive knowledge of California raptors and his persistent emphasis of the importance of thorough species accounts to evaluate the conservation status of potentially at-risk birds. CDFG biologists Lyann Comrack and Kevin Hunting were indispensable in guiding the deliberations of the advisory committee, facilitating the production and revision of range maps, supporting the authorship of the overview text and species accounts of this document, and performing various behind-the-scenes but vital administrative duties (in which they were also aided by Esther Burkett and Bill Kindred). Notably, Lyann Comrack's unswerving dedication to this project greatly elevated its overall quality. Advisory committee members and other authors contributed the heart of the document by writing the individual species accounts. Unpublished county breeding bird atlas data were kindly provided by Larry Allen (Los Angeles County), Bill Bousman (Santa Clara County), Tom Edell (San Luis Obispo County), Steve Glover (Contra Costa County), Bill Grummer (Napa County), John Hunter (Humboldt County), Rick Johnson (San Mateo County), Tim Manolis (Sacramento County), Rusty Scalf (Alameda County), Dan Singer (San Francisco County), and Philip Unitt (San Diego County). From maps hand-drafted by species account authors, Kristi Fien, Nicholas Hansen, and Kiffanie Stahle of CDFG digitized distribution maps, summarized data from them, and prepared the cartography used in the final publication. Richard Erickson and John Sterling ensured the quality of these maps by serving as technical editors for their production. Kimball Garrett and Philip Unitt provided technical advice regarding taxonomic issues and distributions of subspecies. Tim Manolis and Michael Patten scored the bulk of the nominated taxa; Manolis also drafted a preliminary version of the ranking criteria. Sam Fitton provided a perspective on the use of state lists of at-risk species for management and conservation planning by federal agencies. Grant Ballard helped with computer and website support. Diana Stralberg and Lars Pomara prepared the maps for Bird Conservation Regions and geographic subdivisions of California. David Compton copy-edited the entire draft manuscript. Philip Unitt assisted by copy-editing some of the front matter added later and by providing invaluable insight throughout. On short notice, Jaime Jahncke kindly translated the abstract to a Spanish resumen, which was copy-edited by Karen Levy-Szpiro. Catherine Waters graciously provided moral support and help in resolving behind the scene issues related to publication and distribution of the monograph. Special thanks to Andy Birch and Tim Manolis for their splendid line drawings interspersed in the text and to Keith Hansen for the stunning color plate used on the cover. Tim Brittain expertly typeset the text and designed the layout and cover.

We greatly appreciate the contributions of the following individuals who made helpful comments on the draft special concern list, reviewed species accounts or maps, shared unpublished data and observations, checked proofs, or otherwise freely offered information, insights, and encouragement, all of which collectively greatly enhanced the quality of this document: Angela Aarhus, Sue Abbott, Ken Able, Josh Adams, Linda Adams, David Ainley, Dan Airola, John Alexander, Matt Alexander, Bob Allen, Larry Allen, Lewis Allen, Sarah Allen, Robert Altman, Jon Amsden, Bertin Anderson, Dan Anderson, Carlos Arce, Keith Axelson, Kate Baird, Allan Baker, Grant Ballard, Jack Barclay, Bob Barnes, Alan Barron, Sean Bechta, Ted Beedy, Teresa Benson, Murray Berner, James Bland, Sam Blankenship, Clark Bloom, Pete Bloom, Robert Blumenthal, William Boarman, Bill Bousman, Gerald Braden, Russ Bradley, Clait Braun, Amedee Brickey, Bev Brock, Steve Brueggemann, Jennifer Buck, Joelle Buffa, Esther Burkett, Ryan Burnett, Ken Burton, Tom Cade, Kurt Campbell, Eugene Cardiff, Harry Carter, Michael Casazza, Ed Cassano, L. Ochikubo Chan, Yvonne Chan, Sal Chinnici, Dan Christy, Steve Clay, Andy Cohen, Luke Cole, Brian Collins, Charlie Collins, Josh Collins, Paul Collins, Dave Compton, Lyann Comrack, Chris Conard, Tamara Conkle, Courtney Conway, Bea Cooley, Dan Cooper,

René Corado, Diana Craig, Jack Crayon, Leah Culp, Jeff Davis, Richard DeHaven, Adrian del Nevo, Bill Deppe, Dave DeSante, Anthony Desch, Bruce Deuel, Bob Dickerman, Rick Dimick, Rod Drewien, Jon Dunn, Linda Dye, Linda Eade, Tom Edell, Leo Edson, Ray Ekstrom, Craig Ely, Josh Engel, Andrew Engilis, Sid England, Joe Engler, Andrea Erichsen, Richard Erickson, Jules Evens, Sarah Fangman, Kate Faulkner, Dave Feliz, Kimberly Ferree, Chad Fien, Allen Fish, Sam Fitton, Terri Fitton, David Fix, John Floberg, Rob Fowler, Larry Fox, Scott Frazer, John Fulton, Dave Furseth, Jim Gain, Terri Gallion, Scott Gardner, Kimball Garrett, Luke George, Greg Gerstenberg, Jennifer Gervais, Geoff Geupel, Robert Gibson, Dan Gifford, John Gilardi, Robert Gill, David Gilmer, Steve Glover, Rick Golightly, Gordon Gould, Jihadda Govan, Frank Gray, Helen Green, John Green, Mike Green, Letitia Grenier, Bill Grummer, John Gustafson, Daniel Guthrie, Tonya Haff, Frank Hall, Robb Hamilton, William J. Hamilton III, Jeanne Hammond, Steve Hampton, Rob Hansen, Dave Hardt, Lori Hargrove, Jill Harley, Ed Harper, John Harris, Stan Harris, Ray Hasey, William Hayes, Loren Hays, Gjon Hazard, Sacha Heath, Matt Heindel, Tom and Jo Heindel, Roger Helm, Michelle Hester, Rob Hewitt, Catherine Hickey, Howard Highley, Roger Higson, Osvel Hinojosa, Aaron Holmes, Mark Holmgren, Geoff Holroyd, Waldo Holt, Dan Horner, Sandra Howerton, Robert Huddleston, Diana Humple, John Hunter, William Hunter, Kevin Hunting, David Hyrenbach, Craig Isola, Gary Ivey, Deborah Jaques, Alvaro Jaramillo, Joseph R. Jehl Jr., Brenda Johnson, Rick Johnson, Lee Jones, Paul Jorgensen, John Keane, Kathy Keane, Bill Keener, Tom Keeney, Robert Keiffer, John Kelly, Paul Kelly, Jeff Kidd, Anne King, Howard King, Jon King, Donald Klebenow, Rob Klinger, Peter Knapp, Josh Koepke, Sandy Koonce, Stan Kostka, Gary Kramer, Kim Kreitinger, Dean Kwasny, Jeremy Kwolek, Bill La Haye, Paul Lamos, Larry LaPre, David Larson, William Laudenslayer Jr., Lyndal Laughrin, Steve Laymon, Howard Leach, Derek Lee, Robin Leong, Tom Leskiw, Gary Lester, Russ Lewis, Carroll Littlefield, Len Liu, Kent Livezey, Mickey Long, Dan Loughman, John Lovio, David Lukas, Victor Lyon, Jennifer McBroom, Guy McCaskie, Gerry McChesney, John McCormick, Chris McCreedy, Chet McGaugh, William McIver, Robert McKernan, Tim Manolis, Viviane Marquez, Elaine Marquis-Brong, John Martin, Paige Martin, Matthew Matthiessen, Dave Mauser, Dave Mayer, Robert Meese, Peter Metropulos, Joe Meyer, Martin Meyers, Gary Milano, Bob Miller, Richard F. Miller, Kyra Mills, Greg Minnery, Patrick Mock, Kathy Molina, Clark Moore, Jeff Moore, Stan Moore, Polo Moreno, Robert Motroni, Thomas Munton, Steve Myers, Kristie Nelson, Kris Neuman, Chris Niemela, Cully Nordby, Mary Nordstrom, Nadav Nur, Andrew Orahoske, Lew Oring, Dennis Orthmeyer, Mike Osbourne, Gary Page, Tom Palmer, Ed Pandolfino, Mike Parker, Peter Paton, Michael Patten, Robert Patton, Mark Paxton, Charles Pelizza, Julie Perrochet, Mike Peters, Stacy Peterson, John Piatt, Mark Pierson, Jim Pike, Lars Pomara, Ken Popper, Carolyn Pratt, Kathy Purcell, John Ranlett, Tom Ratcliff, Paul Rauch, Pete Rawlings, Amadeo Rea, Gordon Reetz, Harold Reeve, Fritz Reid, J. V. Remsen Jr., Carl Rey, Will Richardson, Bob Richmond, Dave Richter, Matt Ricketts, Tom Rickman, James Rising, Don Roberson, Carol Roberts, John Robinson, Gary Roemer, Mike Rogers, Dan Rosenberg, John Roser, John Rotenberry, Thomas Rothe, Gary Rotta, Ruth Rudesill, Miko Ruhlen, Loren Rupert, Tom Ryan, Salton Sea National Wildlife Refuge staff, Mike San Miguel, Larry Saslaw, John Sauer, Rusty Scalf, Ron Schlorff, Larry Schmahl, Alan Schmierer, Jeff Seay, Debra Shearwater, Jay Sheppard, Ginny Short, Joe Silveira, Dan Singer, Todd Sloat, Stacy Small, Dave Smith, Jim Snowden, Mark Sogge, Hildie Spautz, Larry Spear, Kevin Spencer, Rich Stallcup, Dale Steele, Jim Steele, Rose Stefani, George Steger, John Sterling, Tim Steuer, Terri Stewart, San Stiver, Michael Stone, Brad Stovall, Diana Stralberg, Cheryl Strong, Craig Strong, David Suddjian, Brian Sullivan, Steve Summers, William Sydeman, Jean Takekawa, John Takekawa, Michael Taylor, Chris Tenney, Bernie Tershy, Julie Thayer, Dorothy Tobkin, John Trochet, John Turman, Philip Unitt, Kent VanVuren, Xico Vega, Jared Verner, Nils Warnock, Pete Warzybok, Ken Weaver, Bruce Webb, Walter Wehtje, Dan Welsh, Jerry White, Mary Whitfield, Darrell Whitworth, Bud Widdowson, Margaret Widdowson, Alan Wight, Roger Wilbur, David Wilcove, Bob Wilkerson, Brian Williams, Pam Williams, Rick Williams, Doug Willick, John Wilson, Ulrich Wilson, Jon Winter, Kirsten Winter, Peter Witter, Tom Wodetzki, Mike Wolder, Mike Womack, Brian Woodbridge, David Woodward, Roy Woodward, Dennis Woolington, Susan Yasuda, David Yee, Rich Young, Dan Yparraguirre, Bob Yutzy, Carol Yutzy, Gary Zahm, and Fred Zwickel.

Primary financial support for the Bird Species of Special Concern project was provided by CDFG's Species Conservation and Recovery Program via funds from CDFG's Rare and Endangered

Species Preservation Program (Tax Check-off; coordinated by Kevin Hunting and Dale Steele), U.S. Fish and Wildlife Service's Partnerships for Wildlife Act (coordinated by Verlyn Ebert), and the Federal Aid in Wildlife Restoration Program (Pittman-Robertson) and from CDFG's Landowner Incentive Program via funds from the U.S. Fish and Wildlife Service's Division of Federal Assistance and CDFG's Comprehensive Wetland Habitat Program (coordinated by Dean Kwasny and Dave Smith). Additional funding was provided to PRBO or Western Field Ornithologists by Audubon California, the Eastern Sierra, Kerncrest, Madrone, Plumas, Sacramento, San Joaquin, Santa Barbara, Santa Clara, Santa Monica Bay, Sequoia, Sierra Foothill, and Yolo Audubon chapters of National Audubon, BonTerra Consulting, the Bureau of Reclamation, the David and Lucile Packard Foundation, EDAW, H. T. Harvey & Associates, Jones & Stokes, LSA Associates, The Nature Conservancy, SWCA Environmental Consultants, individual members of PRBO, and the sales of signed color prints facilitated by Keith Hansen. The following individuals made substantial efforts to seek funding for the work on this project or its publication: Dan Airola, John Baker, Graham Chisolm, Janet Cobb, Ellie Cohen, Lyann Comrack, Geoff Geupel, Catherine Hickey, Kevin Hunting, Dean Kwasny, Robin Leong, Mike Parmeter, Jim Quinn, Mark Reynolds, Tom Ryan, Mike San Miguel, Dave Smith, Lang Stevenson, and Nils Warnock. Geoff Geupel assisted with administrative support, as did Nils Warnock, and ensured that the special concern list would be adopted by California Partners in Flight. Previous drafts of this document were greatly improved by the insights of Grant Ballard, Ted Beedy, Betsy Bolster, Michael F. Carter, Donald Chadwick, Lyann Comrack, Sam Fitton, Geoff Geupel, Michael Green, Steve Hampton, Joe Hobbs, Kevin Hunting, Ron Jurek, Paul Kelly, Kim Kreitinger, David Lawhead, Kyra Mills, Robert Motroni, Maura Naughton, John Robinson, Dale Steele, Mark Stopher, Dan Yparraguirre, Tara Zimmerman, and an anonymous reviewer. This is contribution 1011 of PRBO.

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Acronyms and Abbreviations

AB	American Birds
AFN	Audubon Field Notes
AI scores	area importance scores
AOU	American Ornithologists' Union
BBA	breeding bird atlas
BBS	Breeding Bird Survey
BCR	Bird Conservation Region
BLM	Bureau of Land Management
BSSC	Bird Species of Special Concern
CalPIF	California Partners in Flight
CAS	California Academy of Sciences
CBC	Christmas Bird Count
CBRC	California Bird Records Committee
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
CWHR	California Wildlife Habitat Relationships
EN	percentage of entire range within California (ranking criterion)
HCP	Habitat Conservation Plan
IPCC	Intergovernmental Panel on Climate Change
GIS	Geographic Information System
LACM	Natural History Museum of Los Angeles County
MAPS	Monitoring Avian Productivity and Survivorship
MCZ	Museum of Comparative Zoology (Harvard University)
MPCR	Middle Pacific Coast (Northern California) region of NAB
MVZ	Museum of Vertebrate Zoology
NAB	North American Birds
NABCI	North American Bird Conservation Initiative
NASFN	National Audubon Society Field Notes
NCCP	Natural Community Conservation Planning (act/program)
NEPA	National Environmental Policy Act
NWR	National Wildlife Refuge
PC	population concentration (ranking criterion)
PIF	Partners in Flight
PRBO	PRBO Conservation Science (formerly Point Reyes Bird Observatory)
PS	population size (ranking criterion)
PT	population trend (ranking criterion)
RS	range size (ranking criterion)
RT	range trend (ranking criterion)
SBMNH	Santa Barbara Museum of Natural History
SDNHM	San Diego Natural History Museum
SPCR	Southern Pacific Coast (Southern California) region of NAB
THR	impact of threats (ranking criterion)
UCLA	University of California, Los Angeles
USDC	U.S. Department of Commerce
USDI	U.S. Department of Interior
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USNM	U.S. National Museum (Smithsonian National Museum of Natural History)
WA	(state) Wildlife Area
WFVZ	Western Foundation of Vertebrate Zoology

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Overview

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Tim Manolis

PDF of Overview section from:

Shuford, W. D., and Gardali, T., editors. 2008. California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

Abstract

To halt or reverse population declines of at-risk native birds, California Department of Fish and Game initiated a process to set conservation and research priorities by revising the initial California Bird Species of Special Concern document (Remsen 1978), which subjectively described declining or vulnerable species. Revision was needed to identify currently at-risk taxa that may warrant listing under the California Endangered Species Act as threatened or endangered if remedial actions are not taken. Working with an advisory committee, we considered 283 bird taxa as nominees for the special concern list, using published data, expert opinion, public input, and national and regional lists of priority or focal species for major conservation initiatives. Nominated taxa were scored for seven objective criteria: population size, range size, population trend, range trend, population concentration, percent of range or population within California, and threats. The Bird Species of Special Concern list was then prepared by evaluating taxa and assigning those qualifying to three levels of priority using both linear and categorical ranking schemes. This ranking process is dynamic, as it allows for scores to be updated as new data become available. The resulting prioritized list consists of 39 species and 24 subspecies or geographic populations. Although unranked, an additional 11 taxa also qualified either because they have been extirpated from the state or are listed as federally, but not state, threatened or endangered. We also developed a California Bird Responsibility List, intended as a tool for longer-term conservation planning, consisting of 125 taxa that qualified because all or a very high proportion of their global populations occur in the state. A taxon's co-occurrence on the special concern and responsibility lists indicates a particularly high level of conservation concern in California. Priority should also be raised for special concern taxa identified as globally vulnerable and for restoration, research, and monitoring projects that are habitat based and benefit multiple species.

Species accounts document the numerical scores for the seven ranking criteria and describe the status, population trends, ecological requirements, threats, and management, research, and monitoring needs for each special concern taxon. Habitats with high numbers of special concern taxa are wetlands, scrublands, grasslands, and riparian forests—all habitats with the highest rates of loss in California. Paralleling continental and worldwide trends, habitat loss and degradation is the greatest threat to California's at-risk birds. Geographic areas with the highest numbers of special concern taxa are southern and central coastal California, where pressures from high and expanding human populations are expected to intensify in coming decades. Currently, most special concern taxa are poorly monitored. Conservation and research efforts should focus on the identification of factors responsible for population declines and adaptive management actions, habitat acquisition, and stewardship that will reverse these declines. The special concern list, if used synergistically with laws, regulations, state policies, and various state or national conservation initiatives, will form an important conservation tool to protect, aid in recovery, and forestall listing actions for the state's at-risk birds. Success will be enhanced if conservation measures are intensified before populations decline further and if they emphasize voluntary rather than regulatory measures.

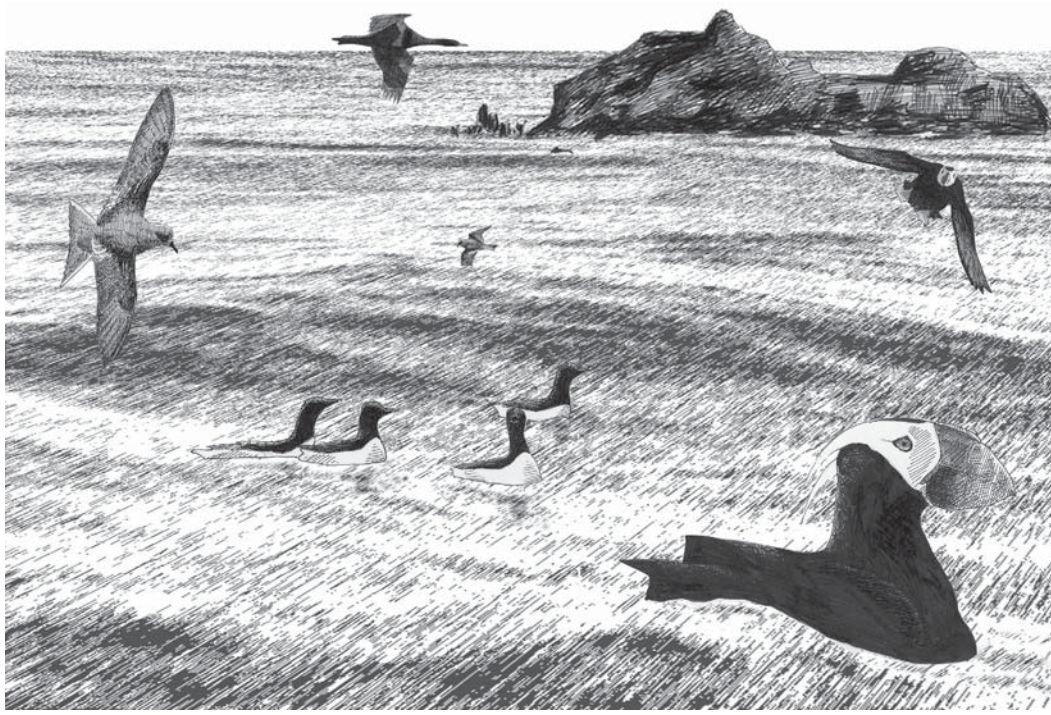
Recommendations for future improvement of the process include frequent review and update of the list, an online database to track new information, refinement of monitoring protocols and research needs, education of stakeholders of the need to protect at-risk birds, and coordination of monitoring efforts and conservation actions with other multispecies and habitat conservation initiatives.

Resumen

Para detener o revertir la disminución de poblaciones de aves nativas en peligro, el departamento de Pesca y Caza de California inició el proceso de establecer prioridades de conservación e investigación revisando la lista preliminar de Especies de Preocupación Especial de California (Remsen 1978) que, de manera subjetiva, describe especies en disminución o situación vulnerable. Se necesitó una revisión para identificar grupos taxonómicos que están actualmente en peligro y que justifican su inclusión en el Acta de Especies en Peligro de California, por estar amenazados o en peligro si no se toman las acciones necesarias. Trabajando con un comité de consulta, se consideraron 283 grupos taxonómicos de aves como candidatos para la lista de preocupación especial. Para tal consideración se usaron datos publicados, opinión de expertos, opinión del público y listas nacionales y regionales de especies de prioridad o especies focales para las iniciativas de conservación más importantes. Los grupos taxonómicos candidatos fueron evaluados utilizando siete criterios objetivos: tamaño de la población, rango de distribución, tendencia poblacional, tendencia de distribución, concentración poblacional, porcentaje del rango de distribución o de la población que ocurre en California y amenazas. La lista de Especies de Preocupación Especial fue entonces elaborada evaluando grupos taxonómicos y asignando los que calificaban a tres niveles de prioridad, utilizando esquemas de clasificación lineal y categórica. Este proceso de clasificación es dinámico, pues permite actualizar las evaluaciones a medida que nueva información se hace disponible. La lista de prioridades incluye 39 especies y 24 subespecies o poblaciones geográficas. A pesar de no haber sido evaluados, 11 grupos taxonómicos también calificaron, ya sea porque fueron extirpados del Estado o por estar listados por el Gobierno Federal, pero no por el Estado, como amenazados o en peligro. También se desarrolló la Lista de Aves de Responsabilidad de California con la intención de que sea una herramienta de largo alcance que se emplee en planeamiento de conservación. Consiste de 125 grupos taxonómicos que calificaron porque toda o una gran parte de su población global ocurre en el Estado. La co-ocurrencia de un grupo taxonómico en las Listas de Preocupación Especial y de Responsabilidad indica un nivel particularmente alto de preocupación sobre su conservación en California. También debe otorgarse prioridad a grupos taxonómicos de preocupación especial identificados como globalmente vulnerables y para proyectos de restauración, investigación y monitoreo que son orientados al hábitat y que beneficiarían a múltiples especies.

La narrativa de cada especie documenta la evaluación numérica de los siete criterios de clasificación y describe el estado de conservación, tendencia poblacional, requerimientos ecológicos, amenazas y el manejo de las investigaciones, además de las necesidades de monitoreo para cada uno de los grupos taxonómicos de preocupación especial. Los hábitats con elevado número de grupos taxonómicos de preocupación especial incluyen humedales, matorrales, pastizales, y bosques riparios—todos hábitats con rápidas tazas de pérdida en California. Comparable a las tendencias en el continente y en el mundo, la pérdida y degradación de hábitat son las mayores amenazas para las aves en peligro de California. Las áreas geográficas con mayor número de especies de preocupación especial se encuentran en las zonas sur y centro de la costa de California, donde se espera que la presión de la alta y creciente población humana se intensifique en las décadas futuras. Actualmente, los grupos taxonómicos de mayor preocupación están siendo pobremente monitoreados. Los esfuerzos de conservación e investigación deberían enfocarse en la identificación de los factores responsables de la disminución poblacional y en acciones de manejo adaptativo, compra de hábitat, y actividades que puedan revertir estas disminuciones. La lista de preocupación especial utilizada de manera conjunta con leyes, reglamentos, políticas de estado y diferentes iniciativas de conservación de nivel estatal y nacional, representa una herramienta importante de conservación para proteger, ayudar en la recuperación y anticipar acciones para listar las aves en peligro dentro del Estado. El éxito se verá enriquecido si las medidas de conservación se intensifican antes de que las poblaciones continúen declinando y si se enfatizan medidas de carácter voluntario en vez de reguladoras.

Las recomendaciones para futuras mejoras en este proceso incluyen una frecuente revisión y actualización de la lista, una base de datos 'en-línea' que permita monitorear nueva información, el refinamiento de los protocolos de monitoreo y requerimientos de investigación, la educación de las personas involucradas en la necesidad de proteger especies en peligro y la coordinación de los esfuerzos de monitoreo y acciones de conservación con otras iniciativas que incluyan la conservación de múltiples especies y de hábitats.



Andy Birch

Introduction

In 1978, California Department of Fish and Game (CDFG) published an annotated list of Bird Species of Special Concern (BSSC). This list summarized the status and range, causes of decline, potential threats, and management needs for 61 taxa (59 species, 2 subspecies) of California birds that had experienced severe population declines or were otherwise vulnerable to future extinction within the state (Remsen 1978). Species were subjectively placed on the list and assigned to three categories based on the perceived urgency of concern for their populations. Although inclusion on the special concern list did not confer legal status equivalent to taxa listed under the California Endangered Species Act, categorization of species was intended to provide guidance in setting priorities for expenditure of research funds, acquisition of habitat, and other management actions. In subsequent years, taxa were periodically added to, or removed from, the list, but no formal review was made of the state's at-risk birds. The last update of the Bird Species of Special Concern list, in 1992, containing 73 taxa (60 species, 13 subspecies), also was subjective, was not annotated, and did not categorize taxa by their level of concern (CDFG 1992).

Californians must overcome daunting problems to maintain the state's superlative biodiversity in the face of severe and ongoing habitat loss and degradation, which has led to population declines of many native species. To meet this challenge, in 1998 CDFG initiated a process to set conservation, research, management, and funding priorities for native birds by forming a Bird Species of Special Concern Technical Advisory Committee, composed of some of California's top field ornithologists, taxonomists, resource agency managers, and conservationists. The charge of the advisory committee was to guide CDFG in revising the original special concern document (Remsen 1978) by developing a scientifically defensible and repeatable method to set objective standards for inclusion of birds on the list, for assigning them to different levels of conservation priority, and for forming the basis for assigning them research priority. Revision was needed to incorporate over 20 years of data to enable identification of currently declining or vulnerable birds that may warrant listing as state threatened or endangered if present trends continue. As a regulatory tool, the special concern list is intended to guide state, federal, and local governments in defining the "sensitive" species under the California Environmental Quality Act, for which analysis of project impacts is required. The special concern list is also meant to stimulate further research on the status, distribution, ecology, and systematics of California's at-risk birds to better aid in their conservation.

The revision of the Bird Species of Special Concern list coincided with a period of rapidly increasing concern for global-to-local loss of biological diversity (e.g., Sisk et al. 1994, Poiani et al. 2000) and with the blossoming of objective schemes to prioritize conservation efforts (e.g., Millsap et al. 1990; IUCN 1994, 2001; Carter et al. 2000; Brown et al. 2000, 2001; Kushlan et al. 2002). The present document joins CDFG's recent special concern reports for amphibians and reptiles (Jennings and Hayes 1994), fishes (Moyle et al. 1995), and mammals (a revision of Williams 1986 is currently under review).

Here we present California's current list of Bird Species of Special Concern and describe the criteria and ranking scheme used to evaluate a large list of nominees and to assign qualifying at-risk species, subspecies, and distinct populations to three levels of conservation priority. We describe patterns of distribution of bird species of concern across habitats and geographic regions of California, rank the relative importance of various threats to all at-risk taxa, and evaluate the adequacy of current monitoring programs for these birds. We also make recommendations for ongoing evaluation of at-risk birds and broad management and research objectives needed to enable effective conservation. These analyses and recommendations are derived in part from individually authored species accounts. These accounts form the backbone of the document by describing the status, population trends, ecological requirements, threats, and management, research, and monitoring needs for each taxon. Finally, and most importantly, we make recommendations for how the special concern list can be used synergistically with laws, regulations, state policies, and various state or national conservation initiatives to protect and aid in recovery of the state's at-risk birds.

Methods

Process and Collaboration

The process of developing the current list of Bird Species of Special Concern was a collaborative one involving several key groups with overlapping membership. CDFG organized the entire effort and formed the technical advisory committee, which developed the definition of a species of special concern and the criteria and ranking scheme used to identify taxa warranting inclusion on the list. The two lead authors worked with CDFG's two-person management team to implement the system developed by the advisory committee; the senior author and one of the CDFG managers were members of the advisory committee. Two of the advisory committee members initially scored most of the nominees for the list. The lead authors scored additional taxa, with some help from other biologists at PRBO Conservation Science (PRBO), and refined many of the scores through the peer-review process. The management team and lead authors selected species account authors, including many advisory committee members, other experts, and themselves. The lead authors drafted the overview and analysis portions of the document and served as technical editors of the species accounts. CDFG organized the development and refinement of the range maps for all taxa, which involved the species account authors and a "map team" including two map editors from the advisory committee, the lead authors, and the management team. Because of the collaborative process and overlap in membership among the key groups, for convenience the collective "we" is often used below when attributing the source of the ideas and methods employed. Ultimately the text conforms with CDFG's overall viewpoint and policies as well as the opinions of the authors, both in the main body of the document and in the individual species accounts.

Context and Underlying Assumptions

Developing a framework for conservation of biodiversity necessarily involves identification of the units, scale, and context involved. Systems for identifying birds warranting conservation concern, however, do not always explicitly discuss these topics. A lack of expression of underlying assumptions can lead to confusion in the application of such schemes. To avoid this pitfall, we describe here our ranking scheme's underlying assumptions, which were developed via extensive discussions of other conservation ranking systems by the advisory committee and given a broader context by evaluation of additional conservation literature.

On this basis, we collectively defined a bird species of special concern, selected a pool of potential nominees to the special concern list, identified objective criteria to score nominated taxa, and developed a ranking scheme to discriminate taxa warranting inclusion on the list and their level of conservation priority within the list.

Units of Conservation

We conservatively defined our units of conservation as species, subspecies, and distinct populations, following the basic approach and intent of the U.S. Endangered Species Act, including its definition of a "distinct population segment" (USDI and USDC 1996, Pennock and Dimmick 1997). This implies a desire to protect species and the genetic diversity within them.

For convenience, throughout the text we refer to species, subspecies, and distinct populations collectively as "taxa" (taxon for singular), though technically "distinct populations" are not taxonomic units. We follow the biological species concept for species, which is adopted by the American Ornithologists' Union (1998). We also follow that source and its supplements (42nd–47th) for scientific names of species (see below for subspecies). Scientific names for all species and subspecies of birds are listed in the tables, except in a few cases when mention is made in the text of subspecies determinations that are not widely accepted.

Increasing advances in molecular genetics have led to considerable debate as to what constitutes a "distinct population segment" and a genetically defined "evolutionarily significant unit" (see overview by DeWeerdt 2002). Recognizing that traditional phenotypic and recent genetic assessments can lead to different conclusions about the distinctness of subspecies and populations (e.g., Zink et al. 2000), we still took the pragmatic approach that phenotypic subspecies are the most applicable unit of conservation below the species level (but see Zink 2004). This approach is based on both the assumption that phenotypic subspecies are likely to represent ecological adaptations and the assumption that genetic studies as yet have limited applicability to birds, given they have been conducted on relatively few polytypic species in California. The proportion of subspecies of birds

considered to represent distinct phylogenetic lineages varied substantially between the broad-scale genetic studies of Zink (2004, 3%) and Phillimore and Owens (2006, 36%), yet both of these may be underestimates (Phillimore and Owens 2006). Complicating such assessments are higher rates of genetic distinctness in the Southern versus Northern Hemisphere and between island and continental taxa (Phillimore and Owens 2006).

Although there has not been a review of subspecific taxonomy of birds in North America or California since that of the AOU (1957), we decided to use that reference, as modified by subsequent published sources, as the basis for subspecific determinations and their scientific names. This recognizes, however, that future evaluation of the diagnosability of subspecies is likely to reduce the number of trinomials (Patten and Unitt 2002). The common names for subspecies used here generally follow those in Grinnell and Miller (1944), subsequent published literature, or those otherwise widely used. When an established common name for a subspecies was lacking, preference was given to one describing the region of geographic occurrence of the taxon or, secondarily, to a patronym mirroring the scientific name.

Including subspecies when prioritizing birds for special concern is consistent with the treatment of subspecies (some of uncertain taxonomic status) in CDFG's documents on amphibians and reptiles (Jennings and Hayes 1994) and mammals (Williams 1986) of special concern. Likewise, despite long-standing controversy about the definitions of subspecies and their taxonomic validity, currently 43% of birds on the federal threatened and endangered lists are included at the subspecies level (Haig et al. 2006). Considerations of subspecies and distinct populations in systems for ranking the conservation concern of birds at the national or continental scale have varied considerably, apparently reflecting different responses to the challenges to doing so mentioned above. For example, Brown et al. (2000) included "distinct population segments or recognized subspecies" when ranking the conservation needs of shorebirds, Carter et al. (2000) and Kushlan et al. (2002) did not when ranking landbirds and waterbirds, respectively, and the USFWS (2002) considered subspecies to only a limited degree when ranking all birds (though they plan to in the future; M. Green pers. comm.).

We restricted the use of distinct populations to ones that appear to be well isolated geographically (and likely genetically) from other large populations of the same species, such as coastal versus interior populations of the Snowy Plover.

California Focus

Given that the context was the conservation of the biodiversity of California's avifauna, we rejected the evaluation of biological factors expressed at the global or continental level. Hence, we did not score taxa on the magnitude of their global or U.S. populations, ranges, or threats as do some other schemes (Carter et al. 2000; Brown et al. 2000, 2001). This does not, of course, preclude additional prioritization on the basis of such factors, as discussed later. We did, however, strike some balance in this regard by deciding to score taxa on a scale from endemic to wide ranging on the assumption that, all else being equal, priority should be given to taxa with a high proportion of their North American population or range within the state. We realized that our California-centrism might lead to inclusion on the special concern list of a relatively high proportion of birds reaching the edge of their range in California and that such an approach has virtues and shortcomings (Hunter and Hutchinson 1994, Peterson 2001). Still, we wanted to emphasize the retention of the state's biodiversity and hence the conservation of all well-established bird populations. Although it can be difficult to define whether a taxon is "well-established," we judged that this category excluded birds occurring as rare migrants, irregular winter or postbreeding visitors, or breeders far from their core range or existing as part of very small populations on the fringe of their range that likely are maintained by recruitment from populations outside of California (e.g., the Laughing Gull, Northern Cardinal, and others in Appendix 1).

Immediate Conservation Concern

We also excluded from consideration most threats to birds that are global or continental in scale. Hence, though we recognize that global climate change is a pressing issue (e.g., IPCC 2007) that may have profound effects on the earth's ecosystems and birds (Moss 1998, McCarty 2001, Parmesan 2006), which may be expressed on California populations, we judged it best to focus on threats that likely can be offset by management actions at the state and local level in the relatively short term. This line of reasoning led to a ranking scheme emphasizing realized effects on birds (population declines, range retractions, and immediate threats) and, secondarily, factors that increase birds' vulnerability to decline or extinction (small population or range size, population concentration).

Nominations for the BSSC List

The advisory committee cast a wide net to ensure a robust list of taxa to evaluate for possible inclusion on the revised Bird Species of Special Concern list. The initial set of nominees included all bird taxa on prior special concern lists (Remsen 1978, CDFG 1992), all candidates to the original list (Remsen 1978), those birds among the "Special Animals" tracked by the California Natural Diversity Database (www.dfg.ca.gov/biogeodata/cnddb/animals.asp), species or subspecies recently considered candidates for listing as federally threatened or endangered (USFWS 1989), all federally threatened or endangered taxa (and populations), taxa nominated by contributors, species showing significant California declines on the Breeding Bird Survey (BBS; Sauer et al. 2001), and species or subspecies endemic to California. The committee excluded from consideration all taxa currently listed as state threatened or endangered by the California Fish and Game Commission (www.dfg.ca.gov/biogeodata/cnddb/animals.asp) because their listed status gives them greater (legal) protection than taxa on the special concern list. Federally listed species also have a high level of (legal) protection but nevertheless were considered further if they were *not* also state listed. Ultimately, each of these federally, but not state, listed taxa, by definition, was given special concern status, as otherwise they would not have received official state status of any kind though they clearly deserved it (see below). The committee also excluded from consideration for special concern status those species introduced to the state, as there is no evidence that such species should be of conservation concern in California (see Patten and Erickson 2001).

Later, PRBO biologists added as nominees species that had high rankings for conservation concern in any of the five Bird Conservation Regions (BCRs) that overlap with California (www.nabci-us.org/bcrs.html, U.S. NABCI Committee 2000; Figure 1). BCRs, as defined by the North American Bird Conservation Initiative (NABCI), are ecological units that provide a consistent spatial framework for bird conservation across North America (www.bsc-eoc.org/international/bcrmain.html). We considered species as having high rankings if for any California BCR they qualified for "Priority Pool Tiers" I or II of the National Partners in Flight (PIF) Rankings (Panjabi 2001; scores available at www.rmbo.org/pif/pifdb.html) or had Area Importance (AI) scores of 4 or 5 in the National Shorebird Conservation Assessment of the U.S. Shorebird Conservation Plan (Morrison et al. 2000). Nominees continued to be added in response to queries from knowledgeable biologists, particularly after a draft list, prepared by the process described below, was posted on the Internet for review. Although the conservation concern rankings of the North American Waterbird Conservation Plan (Kushlan et al. 2002) had not been published by the end of the period of solicitation of nominees for the special concern list, we judge that potential waterbird nominees were adequately scrutinized by the overall process outlined here. Ultimately, 283 taxa were nominated, scored for seven criteria, and ranked for conservation concern as described below.

Criteria and Ranking Scheme

As a means to identify birds that qualify for the special concern list and set levels of conservation priority within the list, the advisory committee debated at length the merits of various ranking schemes and the biological ranking criteria within them (see Ahern et al. 1985, Millsap et al. 1990, Reed 1992, IUCN 1994, Beissinger et al. 2000, Carter et al. 2000). Discussions led to the drafting of a definition of Bird Species of Special Concern in California and development of objective criteria used to score nominated taxa and a method to use the scores to discriminate taxa qualifying for the list and assign them to three levels of conservation priority.

Definition of a Bird Species of Special Concern

To ensure the ranking criteria and scheme would be consistent with the concept of a species of special concern, the advisory committee defined *Bird Species of Special Concern in California* as:

Those species, subspecies, or distinct populations of native birds that currently satisfy one or more of the following (not necessarily mutually exclusive) criteria:

- are extirpated from the state totally or in their primary seasonal or breeding role and were never listed as state threatened or endangered.
- are listed as federally, but not state, threatened or endangered.
- meet the state definition of threatened or endangered but have not formally been listed.
- are experiencing, or formerly experienced, serious (noncyclical) population declines

or range retractions (not reversed) that, if continued or resumed, could qualify them for state threatened or endangered status.
- have naturally small populations exhibiting high susceptibility to risk from any factor(s) that if realized could lead to declines that would qualify them for state threatened or endangered status.

As described below, nominee taxa meeting the first two criteria above qualified for inclusion on the Bird Species of Special Concern list, in a separate category, solely on the basis of meeting these specific definitions. By contrast, all other nominee taxa were judged to meet one or more of the remaining descriptive criteria for inclusion on the list if they met the test of obtaining sufficient total scores, or particular combinations of (fewer) scores, for the various ranking criteria. The latter criteria, by design, quantitatively gauge concern on the basis of characteristics expressed in the verbal definitions above.

Ranking Criteria

The advisory committee decided on seven objective criteria for scoring and ranking a set of nominee taxa: population trend, range trend, population size, range size, population concentration, percentage of entire range or population within California (endemism), and impact of threats. Exclusive of extirpated or federally, but not state, listed taxa, each nominated taxon was scored for all criteria as described below.

Because the distribution and abundance of many taxa in California vary greatly seasonally, and correspondingly in their level of conservation concern, almost all taxa were scored and ranked for their "season of concern" only. In rare cases, taxa (e.g., the Yellow Rail) were scored separately for two "seasons of concern," and thus there were two complete sets of criteria scores. For highly resident species, the season of concern was always "year round." For long-distance migrants, it typically was either "wintering" or "breeding," depending on when the taxon occurred for an extended period within a well-defined range in California. For short-distance migrants that occur year round but vary greatly seasonally in abundance and distribution in the state (e.g., the Northern Harrier), the breeding season typically was the season of concern for which they were scored.

For the population and range trend criteria (and corresponding sections in species accounts), we used the date of publication of Grinnell and Miller (1944) for separating the *historic* and *recent* periods and thus for gauging trends in these criteria for the latter period. This reference provides a convenient benchmark given it is the primary source summarizing the status and distribution of California's birds through the middle of the 20th century. Still, for purposes of scoring, 1944 is simply a cutoff date, and hence we used information from any source, not just Grinnell and Miller (1944), to gauge the status of a taxon at the transition between the historic and recent periods. So as not to prejudge all taxa restricted to marine or coastal habitats *a priori* as having small ranges in California, we set different baselines for marine (or coastal) and upland (or interior wetland) taxa against which to gauge the percent of California they occupied.

Descriptions of the seven criteria are:

Population Trend (PT). This criterion estimates the change in a taxon's population size from the time of the publication of Grinnell and Miller (1944) to the present. Scores are based on quantitative or anecdotal data on the magnitude of population change or, if these are lacking, data on changes in the availability or condition of a taxon's habitat. Taxa may be given a 0 for population trend, even if the California population is declining, if the overall population is stable or increasing and the decline in California results from a geographic shift in the range that was not caused by habitat loss or degradation or other threats in California (e.g., the *minima* subspecies of Cackling Goose).

Population size:	**Score**
seriously (>80%) reduced	20
greatly (>40–80%) reduced	15
moderately (>20–40%) reduced	10
slightly (>10–20%) reduced or suspected of having been reduced but trend unknown	5
stable (≤10% reduced) or increasing	0

Range Trend (RT). The range trend criterion estimates the change in the size of a taxon's breeding or wintering range in California from the time of publication of Grinnell and Miller (1944) to the present. Scores are based on gross changes to a taxon's range polygon (i.e., the outlying boundary of the range). Taxa that currently do not breed in the majority of years in an area where they formerly bred annually are treated as quasi-extirpated there, and hence the area is considered unoccupied for the purposes of calculating range trend (or size). When more thorough data are lacking, range trend can be inferred by loss of habitat. The trend does *not* estimate the extent of local extirpa-

tions within the overall range. Taxa may be given a 0 for range trend, even if the California population is declining, if the overall population is stable or increasing and the reduction in the California range results from a geographic shift in the range that was *not* caused by habitat loss or degradation or other threats in California.

Range size:	
seriously (>80%) reduced	20
greatly (>40–80%) reduced	15
moderately (>20–40%) reduced	10
slightly (>10–20%) reduced or suspected of having been reduced but trend unknown	5
stable (≤10% reduced) or increasing	0

Population Size (PS). This criterion estimates the number of individuals of a taxon in California (during the season of concern).

Population size:	
<1000 individuals	10
≥1000 but <10,000 individuals	7.5
≥10,000 but <100,000 individuals	5
≥100,000 but <1,000,000 individuals	2.5
>1,000,000 individuals	0

Range Size (RS). The range size criterion estimates the percentage of California occupied by a taxon, measured by the range polygon's outlying boundary, that is, *not* by summing the size of all areas of local occupation within the overall range. Taxa that currently do not breed in the majority of years in an area where they formerly bred annually are treated as quasi-extirpated there, and hence the area is considered unoccupied for the purposes of calculating range size (or trend). Seabirds or other waterbirds restricted solely to coastal estuarine, inshore, or pelagic waters are evaluated based on the marine environment from the California coastline west 200 mi (American Birding Association Checklist Area; ABA 2002). All other species are evaluated based on terrestrial California, that is, the political boundary of the state exclusive of ocean waters. This criterion is more difficult to apply for seabirds or waterbirds using ephemeral wetlands in the interior than for solely terrestrial taxa. Still, as the range is determined from the outlying boundary, estimation of its size need not take into account periodic or frequent local shifts in distribution reflecting patchy or ephemeral features in response to changing currents or upwelling patterns, or drying of wetlands during drought. Instead, it should focus on the broad pattern of distribution over a period of years representing the normal range of environmental variation.

Range size (% of California occupied):	
≤10%	10
>10%–50%	5
>50%	0

Percentage of Entire Range within California (EN). This criterion measures what proportion of a taxon's North American range or population occurs within California. Taxa with a high proportion of their range or population within California are considered of greater concern than taxa with only a small proportion of their range or population in the state.

Proportion of North American range or population within California:	
100% (endemic)	10
>80% but <100% (near-endemic)	7.5
>50%–80% (semi-endemic)	5
>20%–50%	2.5
≤20%	0

Population Concentration (PC). This criterion estimates how concentrated a taxon currently is within its California range during critical life stages (e.g., breeding, migration). Highly concentrated taxa generally are considered more vulnerable to habitat loss, predation, disease, or other catastrophic events than are widely dispersed taxa. For example, an endemic subspecies of a landbird might be very vulnerable to a catastrophic fire on one of the Channel Islands. This criterion defines a "site" as any more-or-less disjunct habitat island, including true islands (or offshore rocks) in the ocean or a lake or river, isolated headlands, well-bounded water bodies or wetlands (e.g., coastal estuary, lake, isolated salt marsh), "sky islands" (habitats high on mountain peaks and isolated from similar habitat on other distant peaks), or other well-isolated or fragmented habitat patches. The criterion should be used with caution for taxa that are not colonial breeders.

Majority (>50%) of population concentrated at:	
1–3 sites	10
4–30 sites	5
>30 sites	0

Impact of Threats (THR). This criterion estimates the approximate impact of realized known threats and (secondarily) potential irregularly occurring catastrophic events (e.g., oil spills, disease events) known to periodically affect some taxa. Scores are based on projected long-term realized impacts of single or multiple threat factors and not on speculative threats for which there is no reasonable basis or historic precedent.

In the next 20 years, habitat loss, habitat degradation, or other human-induced threats are projected to:	
seriously reduce (>20%) a taxon's population in California	20
greatly reduce (>15–20%) a taxon's population in California	15
moderately reduce (>10–15%) a taxon's population in California	10
slightly reduce (>5–10%) a taxon's population in California	5
have no substantial net impact, that is, a taxon's population should remain stable (≤5% reduced) or increase in the next 20 years	0

Scoring of Taxa

After the development of an initial list of nominee taxa, as described above, one or more biologists first scored each of these taxa (species, subspecies, or distinct population) on a scale of 0–10 for each of the seven criteria. For each taxon, biologists scored just the population in the season(s) for which the taxon is of concern in California. After considering various alternatives, the advisory committee ultimately doubled the population trend, range trend, and threats scores (to a scale of 0–20) to reflect the emphasis on population declines, range retractions, and threats in the definition of a bird species of concern. Biologists based scores on the best available information, including published papers, unpublished reports, BBS trend data, Christmas Bird Count (CBC) data, published and unpublished breeding bird atlas data, egg set or specimen data, unpublished field notes, and professional opinion. Many scores, however, were rough approximations of actual values, given the frequent lack of precise data. Once complete, the list of scores for all nominees was circulated to all members of the advisory committee for review. Not all members reviewed all scores, and hence, with few exceptions, preliminary scores represented the research or judgment of the initial scoring biologist. To further refine scores, we modified them for some taxa on the basis of outside reviewers' requests for reevaluation, suggestions for specific score changes, assessment by the authors of species accounts, or peer-review or editor evaluations of species accounts (see below). Scores for all nominated taxa are currently available from CDFG.

This scoring system allowed a taxon to be reevaluated for inclusion on, or removal from, the special concern list up to the time of completion of this document on the basis of a request for specific changes to criteria scores submitted by an advisory committee member or other expert. Requests had to be accompanied by substantive but brief written documentation of the reasons for the requested change. In cases of disagreements on scores upon which inclusion or exclusion from the list hinged, each of the authors and CDFG managers independently reevaluated scores then collectively reached consensus on their best judgment on the appropriate score. They then forwarded their recommendations on scores to the full technical advisory committee for final approval or further discussion.

Ranking Scheme

The advisory committee settled on two methods—one *linear*, the other *categorical*—to identify taxa for inclusion on the special concern list as a whole and within three levels of conservation priority. Two methods were used because of substantial controversy in the literature regarding the merits and shortcomings of these alternative approaches (e.g., Beissinger et al. 2000, Carter et al. 2000) and the belief that different methods might identify birds of conservation concern for different but complementary reasons.

The *linear* scheme sums scores for all seven criteria and ranks the nominee list by total score (higher scores indicating greater concern). For the linear scheme, we assigned three levels of priority by identifying natural breaks in the list of total scores. The *categorical* scheme identified taxa both for inclusion on the list and within three levels of priority based solely on one or a few criteria scores. We combined the results of the linear and categorical approaches, as described below, to obtain a final Bird Species of Special Concern list.

Whether scored or not, some additional taxa were added to the list solely on the basis of meeting one of the criteria in the definition of a species of concern. These included (1) taxa extirpated as breeders in California and (2) taxa listed as federally, but not state, threatened or endangered. These are listed in Table 1 in corresponding categories of special concern, but no species accounts were written for them. We judged accounts unnecessary for such taxa because they were not scored, and hence no documentation for scores was needed. Also, extensive documentation of status, threats, and management needs is readily available elsewhere for listed taxa, and accounts would be unlikely to benefit extirpated taxa.

Linear scheme. The linear scheme is a *weighted* one in that the population trend, range trend, and

threat scores are doubled relative to other criteria, to emphasize the importance of declines over vulnerability. The scores for all criteria for each taxon were summed and arranged from highest to lowest. After inspection of the initial list of scored taxa, the advisory committee drew an arbitrary line, on the basis of collective professional judgment, thereby including on the linear ranked list all taxa with summed scores ≥37.5. Further, they used natural breaks in the data for all taxa to divide the linear list into three levels of priority: first priority, scores ≥60; second priority, scores ≥47.5 and <60; and third priority, scores ≥37.5 and <47.5.

Categorical scheme. Like the linear scheme, the categorical scheme outlined here emphasizes scores for population trend, range trend, and threats. Instead of adding all scores for all criteria, however, the categorical approach uses one or several scores to simultaneously develop the list and discriminate between three levels of priority. The criteria scores needed for inclusion in each of three (arbitrarily defined) priority levels and their verbal equivalents are:

First priority: PT or RT = 20, *or* THR = 20 and PT or RT = 15. Population or range size seriously reduced *or* population or range size greatly reduced and threats projected to seriously reduce the taxon's population in California in the next 20 years.

Second priority: PT or RT = 15, *or* THR = 15 and PT or RT = 10. Population or range size greatly reduced *or* population or range size moderately reduced and threats projected to greatly reduce the taxon's population in California in the next 20 years.

Third priority: PT or RT = 10 and PS, RS, or PC ≥7.5, *or* THR = 15 and PS, RS, or PC ≥7.5. Population or range size moderately reduced and population is at high risk because of at least one vulnerability factor, *or* threats projected to greatly reduce a taxon's population in California in the next 20 years and the taxon's population is at high risk because of at least one vulnerability factor.

Combining methods for the final list. We consolidated qualifying taxa into two main sections on the final list of Bird Species of Special Concern. The first included the taxa qualifying solely on the basis of the definition of a species of concern. The second included those qualifying on the basis of the final ranking scheme, which merged the linear and categorically ranked lists. We merged taxa on the linear and categorical lists by assigning each to one of three levels of priority using the higher of the two priority scores from the two schemes. For example, if a taxon had a priority level score of 2 on the linear list and 3 on the categorical list, we assigned it a 2 on the final list. If a taxon was on one list and not on the other, we assigned it a final priority by the single priority score originally assigned. For example, if a taxon scored a 2 on the linear list but was not on the categorical list, its priority level score on the final list was also 2. As with criteria scores, we adjusted the draft list and priority rankings on the basis of research by species account authors or external review. We solicited review of the list by sending copies directly to selected knowledgeable individuals and, more widely, by posting it on the PRBO website.

Analyses

We used a combination of statistical and descriptive analyses to look for patterns in the data used to classify species of special concern. For all analyses, we recognized that there are important limitations to available biological data and uncertainty as to how these limitations affected our results.

Statistical Analyses

Because scores among various criteria may be highly correlated, and therefore not independent, the validity of a ranking system that simply adds such scores together may be questioned (Beissinger et al. 2000). To address this concern, we looked for correlations among criteria scores for nominated taxa with the Spearman Rank Correlation test in the program STATA, version 8.0 (StataCorp. 2003). We also used this test to compare the concordance of the linear and categorical schemes in assigning taxa to three levels of conservation priority.

Descriptive Analyses

We made descriptive analyses of the patterns of distribution of bird species of concern across habitats and geographic regions of California, of the relative importance of various threats to all at-risk taxa, and of the adequacy of current monitoring programs for these birds. Analyses of geographic patterns were made on the basis of the BCR ecological units (www.nabci-us.org/bcrs.html, U.S. NABCI Committee 2000) and the Jepson geographic subdivisions of California (Hickman 1993; Figures 1 and 2).

Following Wilcove et al. (1998, 2000; D. Wilcove in litt.), we classified threats to special concern taxa into five major categories: habitat loss or degradation, alien species, pollution, over-

exploitation, and disease. For any actual or potential mortality factor to be considered a threat, it typically had to be anthropogenic (human-caused) in origin and to have a demonstrated capacity for population-level effects. Hence, mortality from native predators per se typically was not considered a "threat," although it might threaten the existence of individual birds or small local populations. Likewise, other natural mortality factors, such as inclement weather, tidal inundation, and earthquakes, typically were not considered threats. In extenuating circumstances, various natural mortality factors might be considered threats if substantially augmented by human activities or alterations of the environment or if such activities had reduced an overall population to such a low level that any mortality factor might lead to further declines or extirpation. As noted above, we did not evaluate the effects of global climate change as a threat to California birds, given the unlikelihood it can be offset by management actions within the next 20 years. Like Wilcove et al., in our overall analysis we did not distinguish between historic, ongoing, or current threats. By contrast, in scoring the "impacts of threats" criterion, as described above, the effect of threats was estimated over "the next 20 years." Unlike Wilcove et al., we did distinguish between major and minor threats. We considered major threats as realized threats known or strongly thought to have caused a substantial population decline or range retraction. We deemed minor threats as lesser realized threats or those potential threats that were not yet known or thought to have caused the population-level effects but appear to have the capacity to do so. We first evaluated threats on the basis of evidence available for California. We then considered evidence from other parts of North America if the threat was known or thought to have caused population-level effects on the taxon elsewhere, and if the lack of evidence for similar effects in California was judged most likely to reflect a lack of study rather than a lack of effect.

We considered habitat loss or degradation to include both the direct and indirect effects of human activities that might render a habitat unsuitable or less suitable for birds. Direct effects included removal of native habitat or alteration of its structure (e.g., logging) or resource base (e.g., overfishing) such that it no longer is capable of supporting bird populations of the size it did formerly. Indirect effects of habitat degradation included changes in conditions such as those leading to an increase in Brown-headed Cowbird (*Molothrus ater*) populations such that rates of brood parasitism by cowbirds would substantially lower reproductive rates of certain birds. We considered cowbird parasitism a form of habitat degradation for a particular taxon even if the habitat degradation that increased cowbird populations occurred in a habitat not occupied by the at-risk taxon in question. Degradation of habitat might also change the structure of habitat in a manner that would enhance predation rates by native or non-native predators. For example, degradation or elimination of transitional habitats at the upland edge of tidal marshes by diking might increase predation rates on Yellow Rails because they would no longer have adequate cover during very high tides. Habitat degradation might also include the *addition* of stationary objects, such as power lines, tall buildings, and lighthouses, that might greatly increase rates of mortality from bird collisions. We also considered all types of human disturbance to be forms of habitat degradation, except for cases clearly identified as overexploitation by means of direct and purposeful killing, as defined below. Thus, we considered human disturbance that indirectly reduces nesting success or increases adult mortality to be a form of habitat degradation rather than overexploitation. For example, we deemed the bright lights of squid fishing operations, which potentially may lead to burrow abandonment by storm-petrels or murrelets or may increase predation rates by owls on nocturnal seabirds, to be a form of habitat degradation via human disturbance.

We defined alien species as those with naturalized self-sustaining populations, thus excluding agricultural crops. We then considered alien species to be threats if they compete with birds directly for space, food, or other resources (e.g., European Starlings excluding Purple Martins from nesting cavities) or indirectly by altering their habitat (e.g., tamarisk reducing the suitability of riparian habitat), or if they directly prey on birds (e.g., feral cats killing various songbirds). In some cases, alien species might alternatively have been classified as a form of habitat degradation. For consistency with the Wilcove et al. classification, however, we followed their reasoning that in such cases the ultimate cause is the "alien species" rather than "habitat degradation," given the former is causing the latter (D. Wilcove in litt.).

We considered pollution to be a threat if there was evidence of substantial and relatively widespread mortality or reproductive harm from direct exposure or food chain accumulation of pesticides,

heavy metals, metalloids (e.g., selenium), and other contaminants, or direct effects on birds or their prey from siltation or excess inputs of nutrients (e.g., hypereutrophication). Although contaminants potentially might harm any bird taxon, we did not consider pollution a minor direct threat unless there was clear evidence of low-level mortality, sublethal accumulation in tissues, or eggshell thinning. Pollution was also considered an indirect threat if it reduced the prey base of a bird taxon and thereby reduced the size of the population that could be supported by a given habitat.

We considered overexploitation to be primarily direct and purposeful (but overzealous) killing for commercial or sport hunting (food, plumes), for fear of competition with human interests (e.g., killing of fish-eating birds), for scientific collections, and for other purposes, as well as vandalistic killing. Hence, we generally restricted overexploitation to cases where the destruction of the taxon was the intent or the direct byproduct of the act. Although perhaps inconsistent with this rule, we categorized mortality of birds during gill-netting for fish harvest as overexploitation. Like Wilcove et al. (D. Wilcove in litt.), we felt less comfortable classifying such cases as habitat degradation.

We considered diseases to be threats if they had the capacity for population-level effects, particularly in cases of introduced diseases, natural diseases whose effects are augmented by human activities or alterations of the environment, or natural diseases affecting bird populations already at tenuously low levels.

Bird Responsibility List

Dunn et al. (1999) used responsibility scores to indicate a high degree of stewardship responsibility for the conservation of landbirds in Canada. In that vein, we developed a California Bird Responsibility List to highlight taxa for which the state should bear stewardship responsibility for conservation. We set the standard for inclusion on the list as those taxa with relatively high scores for the EN criterion: species or subspecies with scores of 10 or 7.5 (i.e., all endemic or "near-endemic" taxa) and additional species (but *not* subspecies) having scores of 5 (i.e., "semi-endemic" species). Thus, qualification for inclusion did not hinge on a taxon's current level of conservation concern.

Taxa to Watch

We also identified taxa for inclusion on a list of "Taxa to Watch" on the basis of prior concern for the well-being of their populations in California. We defined "Taxa to Watch" as those that are not on the current special concern list that (1) formerly were on the 1978 (Remsen 1978) or 1992 (CDFG 1992) special concern lists and are not currently listed as state threatened and endangered, (2) have been removed (delisted) from either the state or federal threatened and endangered lists (and remain on neither), or (3) are currently designated as "fully protected" in California (www.dfg.ca.gov/wildlife/species/t_e_spp/fully_pro.html).

Species Accounts

Numerous authors wrote species accounts that describe the status, population trends, ecological requirements, threats, and management, research, and monitoring needs for each taxon on the ranked list of Bird Species of Special Concern. These accounts provide scientific documentation for the criteria scores. This information justifies each taxon's inclusion and priority ranking within the special concern list and the biological underpinnings for recommendations to those responsible for making decisions that affect the conservation of these birds. Accounts summarize current knowledge and information gaps for special concern birds in a standard format with a range map and 11 sections, described below.

Criteria Scores

This is a table of the seven criteria scores for each taxon, presented with the range map for each taxon.

Special Concern Priority

This section describes the current level of special concern (conservation) priority and the season of concern (e.g., breeding, wintering, year round). If applicable, it also describes the priority in the original list (Remsen 1978) and whether the taxon was included on the most recent unprioritized list (CDFG 1992). Identification of the season of concern for each taxon focuses conservation efforts where they are most needed. Still, this should not be interpreted too rigidly. For example, although breeding is the season of concern for the Ashy and Black storm-petrels, this should not preclude conservation efforts at other seasons when large concentrations of individuals at sea may leave these species particularly vulnerable to catastrophic events. Particular vulnerabilities in California outside the season of concern, if applicable, generally are discussed in the threats section of accounts.

Breeding Bird Survey Statistics for California

This section presents a summary table of the most recent BBS data for the taxon when data for California are suitable for trend analysis (Sauer et al. 2005), which is not the case for any subspecies on the BSSC list. Descriptions of the BBS trend, or lack thereof, are included in the text of the section on "Recent Range and Abundance in California," according to the following standards and terminology. Statistical significance is defined as any trend with a P value of ≤ 0.10. Levels of significance (or near significance) are described verbally in the text (on the basis of the table's P values) as *highly significant* ($P < 0.01$), *significant* ($P = 0.01$–0.05), *marginally significant* ($P = 0.06$–0.1), and *approaching significance* ($P = 0.11$–0.19). Trend data are reported only if they meet the data credibility rankings of *high* (blue) or *medium* (yellow) as defined by Sauer et al. (2005). High credibility (blue) reflects data with at least 14 samples, of moderate precision, and of moderate abundance on survey routes; medium credibility (yellow) reflects data with a deficiency. Low (red) reflects data with an important deficiency, thus indicating that a taxon is not well sampled by the BBS in California.

General Range and Abundance

This section briefly and broadly describes the taxon's North American (and, if applicable, global) range and abundance, thereby justifying the endemism score. As applicable, it distinguishes between patterns of distribution for breeding, migration, and winter and for summering nonbreeders outside the breeding range; it does *not* describe patterns of extralimital occurrence. For polytypic species, the number of subspecies is described; this may include a range in the number of recognized subspecies if this varies according to different authorities. In accounts for subspecies, conflicting taxonomic treatments are described in more detail.

Seasonal Status in California

This section briefly describes the *primary* seasonal status and period of occurrence of the taxon in California. For nesting species, the period of the *breeding season* is defined as the time from the laying of the first eggs through the fledgling of the last young.

Historic Range and Abundance in California

The *historic* (vs. *recent*) period was defined as being up to, and including, the publication of Grinnell and Miller (1944). This section describes the abundance and distribution of a taxon in California prior to 1945, thereby establishing a baseline against which population trend, range trend, and, to a lesser degree, threats can be judged. It also describes features not easily mapped, such as any geographic or subspecific variation in status (e.g., clinal variation in abundance), particular dispersion patterns (e.g., patchy, clumped), or other distinctive patterns of distribution and abundance. The historic range is mapped only if it differs substantially from the current range (see below).

Recent Range and Abundance in California

This section describes the distribution and abundance of a taxon in California from 1945 to the present. Comparisons to the historic period to describe population and range trends serve to justify the criteria scores for population and range size and trend. The text on the current range complements the accompanying range map (see below) by describing the range relative to county boundaries, geographic areas (e.g., Sacramento Valley), or physiographic regions (e.g., Mojave and Colorado deserts). Like the previous section, this one describes patterns of geographic variation in status.

Ecological Requirements

This section discusses the habitat and other ecological requirements of the taxon in California, focusing on details of factors that may limit the taxon or that are otherwise particularly relevant to managers. As applicable, it describes or summarizes seral stage, dominant plants, and structure of habitats occupied; geographic or seasonal variation in habitat use; key habitat features (e.g., snags, cavities, canopy layers); noteworthy adaptations; known population-limiting factors; seasonal habitat use in terms of latitudinal and altitudinal range, climatic limits, and topography; and important components of food, cover, and nesting substrate.

Threats

This section describes the type and severity of threats known or highly suspected of causing population-level effects on a taxon in California.

Applicable threats elsewhere are described only when little information is available on these threats in California. Potential threats are clearly labeled as such. When possible, authors express judgments of the capability of current and future threats to reduce the population or range size or to alter distribution patterns or habitat use of the taxon in California.

Management and Research Recommendations

This section consists of a bulleted list of recommendations, including management measures to stem or reverse population declines, range retractions, or population threats, and research needed to better guide management and restoration efforts.

Monitoring Needs

This section assesses the adequacy of current statewide monitoring strategies (e.g., BBS, Monitoring Avian Productivity and Survivorship [MAPS] program, CBC) to detect changes in the population trend of each taxon. Although it is beyond the scope of each account to make detailed recommendations on specific monitoring protocols for each taxon, account authors do suggest ways of improving current monitoring methods or implementing new ones. In the process, they address the need for standardized protocols and the estimated frequency of monitoring.

Range Maps

Approach and considerations. Even when based on the same information, maps can vary enormously depending on the approach taken. In this document, we generally strove to map the "range" of each taxon rather than its local distribution. Thus, we have mainly mapped the broad region(s) in which a taxon occurs rather than its known occurrences or preferred habitats, which often are patchily distributed across broad areas. Even so, the maps for most taxa typically have several to many polygons—within which the birds are patchily distributed—separated from other polygons of occurrence by large blocks of unsuitable terrain, such as large mountain ranges or valleys. Such an approach worked well for most taxa, but had limitations for subspecies restricted to a tiny region of the state (e.g., the Clark's Marsh Wren) or for some species found mainly in the southern deserts, where they are restricted to widely separated montane islands (e.g., the Gray Vireo) or to extremely localized oases of riparian habitat in an overwhelmingly arid landscape (e.g., the Summer Tanager).

In such cases, we deviated from our overall approach to map these exceptions on the basis of occurrence of suitable habitat or local areas of occurrence. In the case of species with extremely localized distributions in the desert, it seemed misleading to map all of a broad area when only a very tiny fraction of it was occupied. For subspecies, the decision to map at this finer scale was done more for practical reasons. In the case of the three subspecies of the Song Sparrow occurring only in portions of the San Francisco Bay estuary, it was easier and more accurate to map the known extent of their preferred tidal marsh habitat. For these and other subspecies, we also judged that various stakeholders would be better served by having more rather than less information on the distribution of these highly restricted and hence vulnerable taxa. Again for practical reasons, we mapped the distribution of subspecies endemic to the Channel Islands on a whole-island basis, as even when the islands are projected at a relatively large size it is difficult, without exaggerated polygons, to see mapped occurrence on the smallest islands, let alone on just portions of them.

For breeding seabirds, we first mapped a buffer around colonies out in an arc representing the approximate maximum at-sea distance that most birds of a given species are known or estimated to travel normally from a colony to forage. We then considered the overall California range of each species to be the area along the coast bounded latitudinally by the outer arc of the buffer from the northern- and southernmost colonies in the state, and bounded longitudinally by the area from the coastline out at sea to the far edge of the buffer distance beyond colonies, or measured simply from the coastline seaward in areas where no active colonies were known. Maps extended to the northern or southern state boundary if the species' range extended beyond it. We judged that overall this was comparable to the method used in mapping the range of species distributed broadly but patchily in the interior of the state.

The range maps that accompany species accounts quickly convey each taxon's range in California, but *only during the season(s) of concern.* Thus, depending on the taxon's life history traits, the mapped season of concern may or may not depict its overall distribution in the state (see discussion above). In such cases, the map caption and the text of the account briefly describe the status and distribution of the taxon in California at other seasons.

Mapping process. Within the context described above, range maps were prepared by the following

process (see Hollander et al. 1994). CDFG first plotted distribution data from various sources (BBS, CBC, California Natural Diversity Database, National Parks Occurrence Data, PIF, other CDFG data) on base range maps of full species initially developed in the mid-1980s as part of their California Wildlife Habitat Relationships (CWHR) system. Next, CDFG annotated these base maps with distribution information from key publications and reports. CDFG then provided account authors with copies of the annotated CWHR species map printed on semitransparent velum, a base map of California, and a map of Ecological Units of California (Goudey and Smith 1994), all at a scale of 1:1,000,000. Authors drew any needed changes on the annotated CWHR map, which they overlaid on the other maps to identify physical and ecological range boundaries when applicable. To ensure map accuracy, account authors used all readily available information to verify the extent of the range of each taxon. Only in a few cases, however, were authors able to obtain pertinent specimen and egg-set data from all major California museums. When they did, it usually was via their prior research on the taxon in question. For subspecies, account authors drew the initial range maps from scratch; otherwise the process for subspecies followed that for species. After authors submitted maps, CDFG reviewed all maps to clarify any questions, digitized them using ArcView GIS (geographic information system) software, returned them to the authors (as needed) for revision, made necessary corrections, then prepared maps at sizes and layouts appropriate for broader review and later publication.

Then the "map team" reviewed all first-draft digitized maps to ensure both the accuracy of individual maps and a consistent approach to the mapping of all taxa. Map team members also used readily available information to sketch the historic range polygons on maps for which the taxon's range had changed substantially since 1945. This enabled CDFG to calculate the size of the current and historic ranges of individual taxa, as applicable, and these numbers were used to verify the range size and range trend scores for all taxa. In a parallel and overlapping process of editing all species accounts, the senior author checked the text describing range in each account against the respective map, and vice versa, to ensure consistency in these two media, editing either as needed and often consulting additional sources or experts.

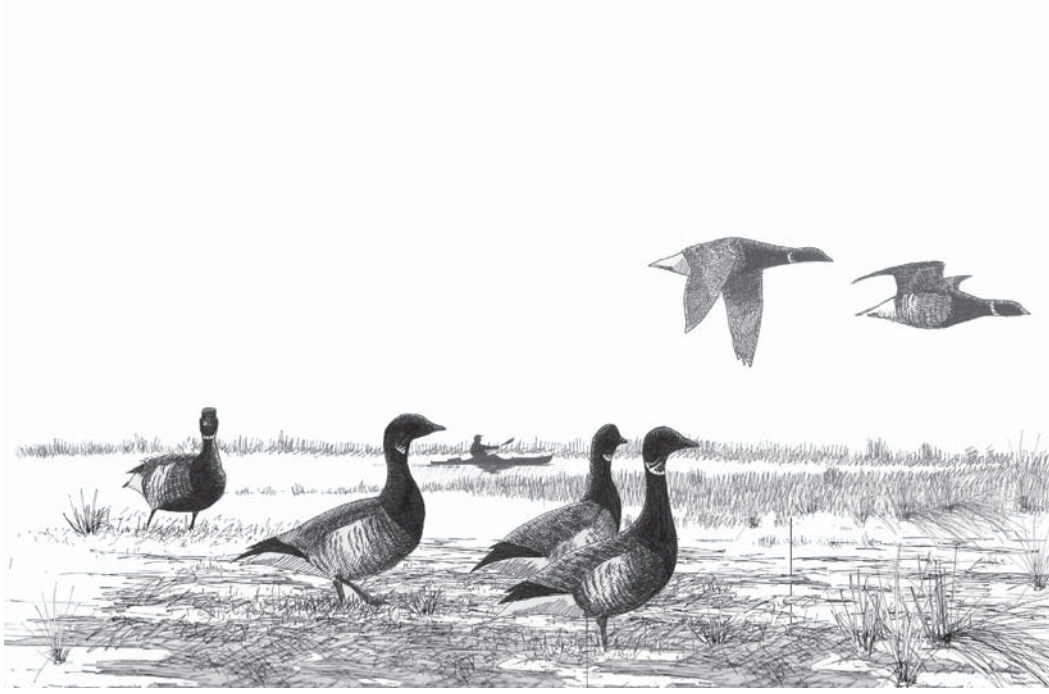
Because many range polygons were initially drawn on the basis of preexisting digitized ecological unit boundaries, often with very precise and complex edges, the map team reached consensus to smooth the polygon boundaries for the publication-scale maps, with CDFG retaining the original polygons for other uses. If the complex ecological unit boundaries had not been smoothed, they may have implied a level of precision not justified by actual distribution data. Conversely, many other of the original polygons were hand drawn with smooth edges because distributions did not correspond with ecological unit boundaries. Thus, smoothing the rough edges of the unit boundaries made the approach and precision of mapping more consistent across taxa.

The map team first evaluated various digital GIS solutions for smoothing the maps but ultimately rejected these in favor of one person (the senior author) hand drawing the smoothed polygon boundaries on hard copies of maps, which CDFG then digitized. Hand smoothing was done in concert with editing and adding historical polygons to maps. Maps were completed by a process of additional review by the map team, full technical advisory committee, and species account authors, with final corrections made by CDFG.

Relationship to criteria scores. We took the somewhat different approaches to mapping for more widely distributed versus very restricted taxa in full knowledge that, beyond the exception for seabirds and other waterbirds restricted to the immediate coast, criteria scores for range size and range trend for all taxa were based on the same definitions. Mapping at a finer scale for the very restricted taxa biased the calculations of their overall range size (sum of all polygons) to give a smaller value than if they had been mapped more liberally; but this had no practical effect, as all of these taxa already had the highest score of 10 for the range size criterion (small range size = high score). In interpreting the range trend score for such taxa, we considered the outlying boundary of the range to be an imaginary line connecting the outermost of the full set of widely spaced, small polygons (i.e., consistent with the typical treatment of historical data/maps). Hence, the loss of one or more scattered polygons to extirpation was not considered valid for assessing the range trend score unless the loss of polygons was substantial and concentrated in an outlying portion of the overall range. Likewise, for colonial seabirds, we did not consider the extirpation of one or more colonies as a valid measure for assessing the range trend score unless the loss of colonies

was concentrated in an outlying portion of the overall range. Localized extirpations and consequent population reductions for all species were captured within the population trend score. This was consistent with a key precept of the ranking system to not score a taxon twice for essentially the same thing.

We judged that the approach and considerations described here were the best for the intended purpose and did not have any unintended effects on the scoring of the range size and range trend criteria, which were ultimately based on, and documented by, the maps.



Andy Birch

Results

Bird Species of Special Concern List

The criteria and ranking scheme identified 74 taxa that currently warrant designation as Bird Species of Special Concern in California (Table 1). Of these, 11 qualified solely on the basis of meeting one of the criteria of the definition of a species of concern: 5 because they had been extirpated from the state entirely or in their primary seasonal or breeding role, 6 because they had been listed as federally, but not state, threatened or endangered. These 11 taxa are not discussed further, as conservation efforts are already mandated for federally listed taxa and little can be done to benefit extirpated taxa, except perhaps to reintroduce the Sharp-tailed Grouse.

Sixty-three taxa warranted designation because they qualified for immediate conservation concern on the basis of their scores for seven biological criteria (Table 1). These taxa were placed within three categories of conservation concern: 11 as first priority, 27 as second priority, and 25 as third priority. Of the 63 taxa, 37 were full species (monotypic species or polytypic species represented by only one subspecies in California), 2 (the Loggerhead Shrike and Yellow Warbler) were polytypic species minus one isolated subspecies ranked separately as being of special concern (the Island Loggerhead Shrike, the Sonora Yellow Warbler), 21 were single subspecies (of species with multiple subspecies within California), and 3 were distinct populations of species. In the last category, the populations of the Le Conte's Thrasher (San Joaquin population) and the Song Sparrow ("Modesto" population) have been assigned subspecific rank by some authors (see accounts). Regardless, these populations and that of the Snowy Plover (interior population) show substantial or complete isolation from other populations of their respective species in California.

Linear versus Categorical Ranking Schemes

Correspondence between the linear and categorical schemes was modest with respect to the taxa each included on the special concern list but high in terms of the priority rankings within the list to which each assigned taxa. Of the 63 taxa on the ranked BSSC list, 42 (67%) were common to both the linear and categorical schemes. The linear scheme identified 55 taxa for inclusion, the categorical 50. Of the 13 taxa identified for inclusion by the linear scheme only, all had relatively high scores for criteria measuring factors that increase birds' vulnerability to decline or extinction and generally low scores for factors that measured realized effects on birds (Table 2). Of these 13, all had very small ranges (RS score of 10; 7 were endemic subspecies) and relatively concentrated populations (PC score $\geq$5), and 11 had small population sizes (PS $\geq$7.5). By contrast, all had low scores ($\leq$5) for population trend. Of the 8 taxa identified by the categorical scheme only, all had the lowest score possible for endemism and population concentration, and 7 had large to moderate range sizes (RS score $\leq$5). Conversely, all had relatively high scores ($\geq$10) for population trend (Table 2).

The linear and categorical schemes showed a relatively high degree of agreement in assigning taxa to three levels of priority within the BSSC list (Spearman Rank Correlation; rho = 0.48, P = 0.0001).

Correlation Among Scores

An analysis of possible correlations among criteria scores for all nominated taxa showed that several criteria were significantly positively correlated. We found that the strongest positive correlations were between RT and PT, RS and PS, PC and PS, PT and THR, RS and EN, RS and PC, and PC and THR (Table 3). For example, taxa that tend to score high on endemism also tend to score high on range size. There were also two significant negative correlations, though the relationships were never strong (i.e., rho for both $\leq$ -0.16). Strong correlations indicate that scores are not independent.

Occurrence by Habitat

The 63 ranked taxa occurred within nine broad habitat classes (Table 4; see also species accounts). Wetlands held 27 taxa, scrub habitats 13, grasslands 12, riparian forests 11, conifer forests 7, oak woodlands 6, marine waters 5, desert woodlands 5, and mixed evergreen forests 1. One species, the Black Swift, was not conveniently classified, as it is an aerial forager that nests very locally on moist sea bluffs or on cliffs behind or near waterfalls in deep canyons in the interior (Grinnell and Miller 1944). In their season of concern, 19 taxa use primarily

Table 1 California Bird Species of Special Concern[a]

Taxa (Species, subspecies, and distinct populations)	Season of Concern[b]
Taxa Assigned to the List Based Solely on the BSSC Definition	
Taxa Extirpated from the State Totally or in Their Primary Seasonal or Breeding Role (5 taxa)	
Barrow's Goldeneye (*Bucephala islandica*)	breeding
Sharp-tailed Grouse (*Tympanuchus phasianellus*)	year round
Common Loon (*Gavia immer*)	breeding
San Clemente Bewick's Wren (*Thryomanes bewickii leucophrys*)	year round
Santa Barbara Song Sparrow (*Melospiza melodia graminea, sensu* AOU 1957)[c]	year round
Taxa Listed as Federally, but Not State, Threatened or Endangered (6 taxa)	
Short-tailed Albatross (*Phoebastria albatrus*)	year round
Snowy Plover (coastal population) (*Charadrius alexandrinus*)	year round
Northern Spotted Owl (*Strix occidentalis caurina*)	year round
San Clemente Loggerhead Shrike (*Lanius ludovicianus mearnsi*)[d]	year round
Alta California Gnatcatcher (*Polioptila californica californica*)	year round
San Clemente Sage Sparrow (*Amphispiza belli clementeae*)[e]	year round
Taxa Assigned to the List by Ranking Schemes	
First Priority (11 taxa)	
Fulvous Whistling-Duck (*Dendrocygna bicolor*)	breeding
American White Pelican (*Pelecanus erythrorhynchos*)	breeding
Wood Stork (*Mycteria americana*)	postbreeding
Tufted Puffin (*Fratercula cirrhata*)	breeding
Island Loggerhead Shrike (*Lanius ludovicianus anthonyi*)	year round
San Diego Cactus Wren (*Campylorhynchus brunneicapillus sandiegensis*)	year round
Le Conte's Thrasher (San Joaquin population) (*Toxostoma lecontei*)	year round
Summer Tanager (*Piranga rubra*)	breeding
San Clemente Spotted Towhee (*Pipilo maculatus clementae*)	year round
Channel Island Song Sparrow (*Melospiza melodia graminea, sensu* Patten 2001)[f]	year round
Tricolored Blackbird (*Agelaius tricolor*)	breeding
Second Priority (27 taxa)	
Brant (*Branta bernicla*)	wintering, staging
Harlequin Duck (*Histrionicus histrionicus*)	breeding
Greater Sage-Grouse (*Centrocercus urophasianus*)	year round
Mount Pinos Sooty Grouse (*Dendragapus fuliginosus howardi*)	year round
Ashy Storm-Petrel (*Oceanodroma homochroa*)	breeding
Least Bittern (*Ixobrychus exilis*)	breeding
Yellow Rail (*Coturnicops noveboracensis*)	breeding, wintering
Mountain Plover (*Charadrius montanus*)	wintering
Black Tern (*Chlidonias niger*)	breeding
Burrowing Owl (*Athene cunicularia*)	breeding
California Spotted Owl (*Strix occidentalis occidentalis*)	year round
Vaux's Swift (*Chaetura vauxi*)	breeding
Olive-sided Flycatcher (*Contopus cooperi*)	breeding
Vermilion Flycatcher (*Pyrocephalus rubinus*)	breeding
Loggerhead Shrike (mainland populations) (*Lanius ludovicianus*)	breeding
Gray Vireo (*Vireo vicinior*)	breeding
Catalina Hutton's Vireo (*Vireo huttoni unitti*)	year round
Purple Martin (*Progne subis*)	breeding

(*continued*)

Table 1 (*continued*)

Taxa (Species, subspecies, and distinct populations)	Season of Concern[b]
Clark's Marsh Wren (*Cistothorus palustris clarkae*)	year round
Yellow Warbler (*Dendroica petechia*)	breeding
Sonora Yellow Warbler (*Dendroica petechia sonorana*)	breeding
Santa Cruz Island Rufous-crowned Sparrow (*Aimophila ruficeps obscura*)	year round
Oregon Vesper Sparrow (*Pooecetes gramineus affinis*)	wintering
Large-billed Savannah Sparrow (*Passerculus sandwichensis rostratus*)	nonbreeding
Grasshopper Sparrow (*Ammodramus savannarum*)	breeding
Alameda Song Sparrow (*Melospiza melodia pusillula*)	year round
Kern Red-winged Blackbird (*Agelaius phoeniceus aciculatus*)	year round
Third Priority (25 taxa)	
Tule Greater White-fronted Goose (*Anser albifrons elgasi*)	wintering
Redhead (*Aythya americana*)	breeding
Catalina California Quail (*Callipepla californica catalinensis*)	year round
Fork-tailed Storm-Petrel (*Oceanodroma furcata*)	breeding
Black Storm-Petrel (*Oceanodroma melania*)	breeding
Northern Harrier (*Circus cyaneus*)	breeding
Northern Goshawk (*Accipiter gentilis*)	year round
Lesser Sandhill Crane (*Grus canadensis canadensis*)	wintering
Snowy Plover (interior population) (*Charadrius alexandrinus*)	breeding
Gull-billed Tern (*Gelochelidon nilotica*)	breeding
Black Skimmer (*Rynchops niger*)	breeding
Cassin's Auklet (*Ptychoramphus aleuticus*)	breeding
Long-eared Owl (*Asio otus*)	breeding
Short-eared Owl (*Asio flammeus*)	breeding
Black Swift (*Cypseloides niger*)	breeding
Bendire's Thrasher (*Toxostoma bendirei*)	breeding
Crissal Thrasher (*Toxostoma crissale*)	year round
Lucy's Warbler (*Vermivora luciae*)	breeding
San Francisco Common Yellowthroat (*Geothlypis trichas sinuosa*)	year round
Yellow-breasted Chat (*Icteria virens*)	breeding
Bryant's Savannah Sparrow (*Passerculus sandwichensis alaudinus*)	year round
Song Sparrow ("Modesto"population)[g] (*Melospiza melodia*)	year round
Suisun Song Sparrow (*Melospiza melodia maxillaris*)	year round
Samuels Song Sparrow (*Melospiza melodia samuelis*)	year round
Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*)	breeding

[a]Subspecific taxonomy follows the AOU (1957) and subsequent revisions published in peer-reviewed journals; see species accounts for details. Boldfaced taxa also occur on the California Bird Responsibility List (Table 8).

[b]Given the distribution and abundance of many taxa in California vary greatly seasonally, the "season of concern" corresponds to the season, or seasons, for which a specific taxon is ranked for conservation priority on the BSSC list (see Methods).

[c]Subspecific validity is uncertain. This subspecies, now extinct, was recognized by the AOU (1957), but has been merged by Patten (2001) with the San Miguel (*M. m. micronyx*) and San Clemente (*M. m. clementae*) Song Sparrows as the [Channel] Island Song Sparrow (*M. m. graminea*).

[d]Subspecific identity of shrikes currently on San Clemente is uncertain. Mundy et al. (1997a, b) provided evidence *L. l. mearnsi* is genetically distinct from *L. l. gambeli* and *L. l. anthonyi*, whereas Patten and Campbell (2000) concluded, based on morphology, that the birds now on San Clemente are intergrades between *L. l. mearnsi* and *L. l. anthonyi.*

[e]Subspecific validity uncertain. Recognized by AOU (1957), but not by Patten and Unitt (2002).

[f]Subspecific validity uncertain; see comment above in footnote [c] regarding proposed merger of various island subspecies.

[g]Recognized by AOU (1957), but not by Patten (2001).

Table 2 Comparison of Criteria Scores and Priority Rankings for Taxa Assigned to the Bird Species of Special Concern List on the Basis of either the Linear or Categorical Ranking Schemes Only[a]

	Criteria Scores[b]							Ranking Scheme[c]	
Taxon	PT	RT	PS	RS	EN	PC	THR	Linear	Categorical
Included by Linear Ranking Only									
Tule Greater White-fronted Goose	5	0	7.5	10	10	5	5	3	–
Catalina California Quail	0	0	7.5	10	10	10	0	3	–
Black Storm-Petrel	0	0	10	10	0	10	10	3	–
Snowy Plover (interior population)	5	0	7.5	10	0	10	5	3	–
Gull-billed Tern	5	0	10	10	0	10	10	3	–
Black Skimmer	0	0	7.5	10	0	10	10	3	–
Black Swift	5	5	10	10	0	5	5	3	–
Catalina Hutton's Vireo	5	0	10	10	10	10	5	2	–
Bendire's Thrasher	5	0	10	10	0	5	10	3	–
Santa Cruz Island Rufous-crowned Sparrow	5	0	7.5	10	10	10	5	2	–
Suisun Song Sparrow	5	0	5	10	10	5	10	3	–
Samuels Song Sparrow	5	0	5	10	10	5	10	3	–
Kern Red-winged Blackbird	5	0	7.5	10	10	5	10	2	–
Included by Categorical Ranking Only									
Northern Harrier	10	0	7.5	5	0	0	10	–	3
Northern Goshawk	10	0	7.5	5	0	0	10	–	3
Long-eared Owl	10	5	7.5	0	0	0	10	–	3
Olive-sided Flycatcher	15	0	5	5	0	0	10	–	2
Loggerhead Shrike (mainland populations)	15	0	5	0	0	0	10	–	2
Lucy's Warbler	10	0	7.5	10	0	0	5	–	3
Yellow Warbler	15	5	2.5	0	0	0	5	–	2
Yellow-headed Blackbird	10	0	7.5	5	0	0	10	–	3

[a]See Methods for how the two ranking schemes each assign taxa to one of three priority categories. None of the taxa assigned to the list on the basis of just one scheme, however, qualified for the first priority category (see below).

[b]See Methods for definitions of criteria scores: PT, population trend; RT, range trend; PS, population size; RS, range size; EN, endemism; PC, population concentration; THR, impact of threats.

[c]Priority rankings assigned: 2, second priority; 3, third priority.

interior wetlands, 8 coastal or near-coastal (e.g., Salton Sea) saline (including estuarine) habitats; the San Francisco Common Yellowthroat uses a combination of saline and brackish estuarine marshes and near-coastal freshwater marshes, and the Bryant's Savannah Sparrow uses a combination of estuarine marshes and moist (upland) coastal grasslands. Of the 11 taxa occurring in riparian habitats, 5 use primarily desert riparian. All 7 taxa identified as being of concern in the nonbreeding season (the Wood Stork, Tule Greater White-fronted Goose, Brant, Lesser Sandhill Crane, Mountain Plover, Oregon Vesper Sparrow, and Large-billed Savannah Sparrow) use either wetlands, grasslands, or a combination of the two.

Table 3 Spearman Rank Correlations (rho) among Seven Criteria Scores for 283 Taxa Nominated for Possible Inclusion on the California Bird Species of Special Concern List[a]

	PT	RT	PS	RS	EN	PC	THR
Population Trend (PT)	—						
Range Trend (RT)	0.40**	—					
Population Size (PS)	0.06	0.03	—				
Range Size (RS)	-0.10	-0.10	0.49**	—			
Endemism (EN)	-0.06	-0.16*	-0.14*	0.33**	—		
Population Concentration (PC)	0.06	0.06	0.46**	0.40**	-0.02	—	
Impact of Threats (THR)	0.33**	0.17*	0.17*	0.02	-0.02	0.22**	—

*, $P < 0.05$; **, $P < 0.001$.

[a]Actually 280 taxa with 283 sets of scores, as 3 taxa scored for two separate seasons.

Table 4 Broadscale Habitat Affinities of Ranked Taxa on the List of California Bird Species of Special Concern[a]

Taxon	MA	WE	RI	CF	MF	OW	DW	SC	GR
Fulvous Whistling-Duck		x							
Tule Greater White-fronted Goose		x							
Brant		*X*							
Redhead		x							
Harlequin Duck		x							
Greater Sage-Grouse								x	
Mount Pinos Sooty Grouse				x					
Catalina California Quail								x	
Fork-tailed Storm-Petrel	x								
Ashy Storm-Petrel	x								
Black Storm-Petrel	x								
American White Pelican		x							
Least Bittern		x							
Wood Stork		*X*							
Northern Harrier		x							x
Northern Goshawk				x					
Yellow Rail		x							
Lesser Sandhill Crane		x							x
Snowy Plover (interior population)		x							
Mountain Plover									x
Gull-billed Tern		*X*							
Black Tern		x							
Black Skimmer		*X*							
Cassin's Auklet	x								
Tufted Puffin	x								
Burrowing Owl									x
California Spotted Owl				x	x				
Long-eared Owl			x	x		x	x		
Short-eared Owl		x							x
Black Swift									
Vaux's Swift				x					
Olive-sided Flycatcher				x					
Vermilion Flycatcher			*X*						
Loggerhead Shrike (mainland populations)						x	x	x	x
Island Loggerhead Shrike								x	x
Gray Vireo							x	x	
Catalina Hutton's Vireo						x			
Purple Martin			x	x		x			
San Diego Cactus Wren								x	
Clark's Marsh Wren		x							
Bendire's Thrasher							x	x	
Crissal Thrasher			*X*					x	
Le Conte's Thrasher (San Joaquin population)								x	
Lucy's Warbler			*X*				x		
Yellow Warbler			x						
Sonora Yellow Warbler			*X*						
San Francisco Common Yellowthroat		x	x						
Yellow-breasted Chat			x						
Summer Tanager			*X*						
San Clemente Spotted Towhee			x			x		x	
Santa Cruz Island Rufous-crowned Sparrow								x	
Oregon Vesper Sparrow									x
Bryant's Savannah Sparrow		x							x
Large-billed Savannah Sparrow		*X*						x	
Grasshopper Sparrow									x
Song Sparrow ("Modesto" population)		x							
Suisun Song Sparrow		*X*							
Samuels Song Sparrow		*X*							

(*continued*)

Table 4 (*continued*)

Taxon	MA	WE	RI	CF	MF	OW	DW	SC	GR
Alameda Song Sparrow		*X*							
Channel Island Song Sparrow								x	
Kern Red-winged Blackbird		x							x
Tricolored Blackbird		x				x			x
Yellow-headed Blackbird		x							

[a]Species classified on the basis of their primary use of various broad classes of habitats (see below); some species classified as having more than one primary habitat. One species, the Black Swift, was not conveniently classified, as it is an aerial forager that nests very locally on moist sea bluffs or on cliffs behind or near waterfalls in deep canyons in the interior (Grinnell and Miller 1944).

MA, marine (nearshore, offshore, and pelagic waters).

WE, wetlands (tidal flats, tidal marsh, freshwater marsh, wet meadows, vernal pools, flooded agricultural fields, and riverine, lacustrine, and estuarine waters). Italics indicate taxa that in their season of concern use primarily coastal or near-coastal (e.g., Salton Sea) saline habitats; all others use primarily interior wetlands, except for the San Francisco Common Yellowthroat and the Bryant's Savannah Sparrow, which use a combination of estuarine marshes and either freshwater marshes or moist upland grasslands, respectively.

RI, riparian forest and woodland. Italics indicate taxa that use primarily desert riparian habitats.

CF, coniferous forest.

MF, mixed evergreen hardwood forest.

OW, oak woodland and oak savanna.

DW, desert woodland (Joshua tree, fan palm, Mohave yucca, ocotillo, and pinyon-juniper).

SC, scrub habitats (chaparral, coastal scrub, desert scrub, and sagebrush scrub).

GR, grassland (native grassland, pastureland, grass-like crops, weedy fields, and sparsely-vegetated cultivated fields). The Gull-billed Tern forages partly in upland and dry agricultural fields, but we did not include it in this habitat category because its affinities generally are only marginally comparable to other species using grasslands.

Geographic Distribution

Ranked taxa were differentially distributed among the major geographic regions of the state (Table 5, Figures 1 and 2). Thirty-six taxa (57%), however, occurred only or mainly in one or two major geographic regions, making them more susceptible than widespread taxa to actual and potential threats. As expected, many of these taxa (16 of 36) with restricted distributions are also endemic or near-endemic subspecies. Of the remaining 20 species and subspecies with restricted distributions within California, 13 are part of more widespread populations to the south or southeast that reach the edge of their ranges in southern (9) or central (4) California, 6 are part of more widespread populations to the north or northeast that reach the edge of their ranges in northern or central California, and 1 is a distinct population of a species with a very widespread range.

The numerical occurrence of ranked taxa varied considerably among major geographic regions (Table 5, Figure 2). The highest total was 37 taxa in Southwestern California, where the list was bolstered by the occurrence of 6 endemic subspecies from the Channel Islands and 5 taxa reaching the northern or northwestern limits of their ranges in California. Central Western California held the next highest total with 30 taxa, the total elevated by 3 endemic subspecies of Song Sparrow in the San Francisco Bay estuary. Totals for all other regions ranged from 18 to 21.

At the level of ecologically defined Bird Conservation Regions (BCRs), the disparity in number of special concern taxa among regions was more striking. BCR 32 (Coastal California) held 52 taxa, whereas the number of taxa in the four other California BCRs ranged from 19 to 27 (Table 5, Figure 1). BCR 32, however, comprises about one-half of the state, including all of the Sacramento and San Joaquin valleys as well as the taxa-rich Central Western and Southwestern California geographic regions. BCR 33 (Sonoran and Mojave Deserts), with 25 taxa, comprises about one-quarter of the state. The remaining three BCRs, with their smaller totals of special concern taxa, combined comprise only about one-quarter of the state.

Threats

The number of taxa affected varied greatly among the five major categories of threats (Table 6). Sixty-one taxa (97%) were affected by habitat loss and degradation, 27 (43%) by alien species, 15 (24%) by pollution, 8 (13%) by overexploitation, and 3 (5%) by disease. Habitat loss and degradation also was considered a major (versus minor) threat in a greater proportion of cases (59 of 61) than was the

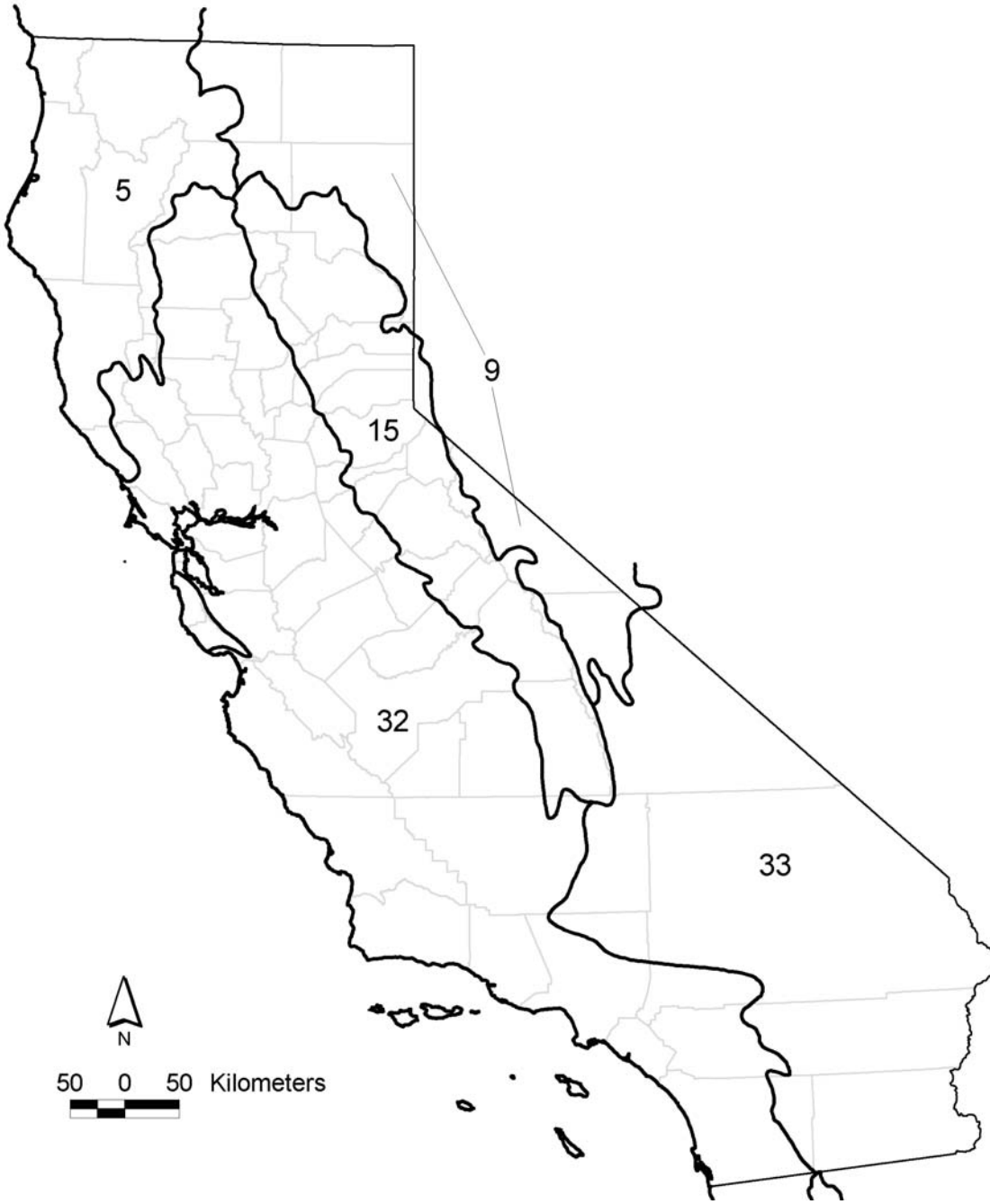


Figure 1. Bird Conservation Regions (BCRs) in California. BCR 5 = Northern Pacific Rainforest, BCR 9 = Great Basin, BCR 15 = Sierra Nevada, BCR 32 = Coastal California, and BCR 33 = Sonoran and Mojave Deserts.

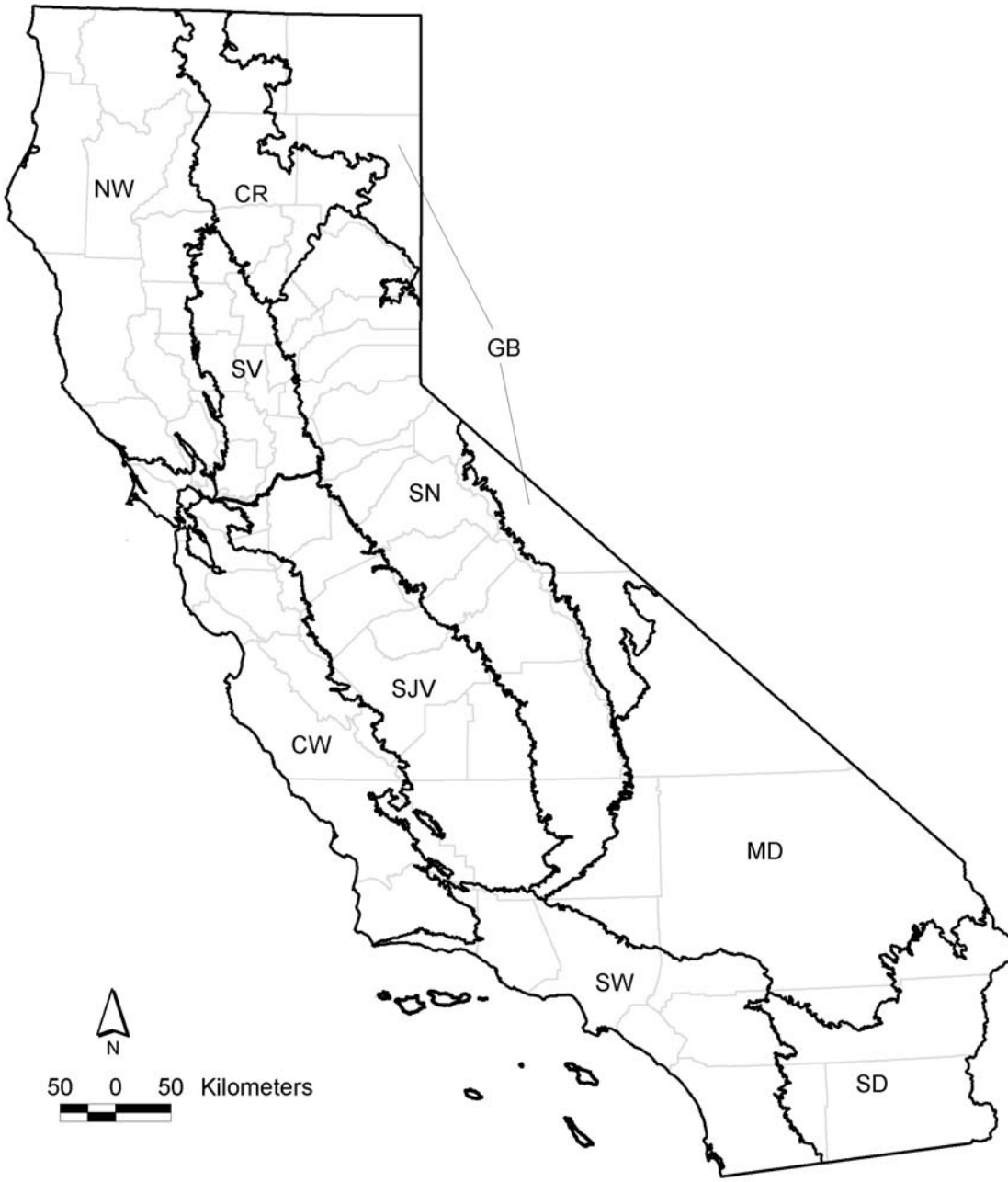


Figure 2. Geographic subdivisions of California adapted from Hickman (1993). NW = Northwestern California, CR = Cascade Range, SN = Sierra Nevada, SV= Sacramento Valley, SJV = San Joaquin Valley, CW = Central Western California, SW = Southwestern California, MD = Mojave Desert, SD = Sonoran (Colorado) Desert, GB = Great Basin.

Table 5 Patterns of Distribution of Ranked Taxa on the List of California Bird Species of Special Concern among Bird Conservation Regions (BCRs) and Geographic Subdivisions of California[a]

	BCR 5		BCR 9	BCR 15	BCR 32				BCR 33	
Taxon	NW	CR	GB	SN	SV	SJV	CW	SW	MD	SD
Fulvous Whistling-Duck[b, d]						x				X
Tule Greater White-fronted Goose[b, e]					X		x			
Brant	X						X	X		
Redhead		x	X		x	x		x	x	x
Harlequin Duck[b, c]				X						
Greater Sage-Grouse[b, c]			X							
Mount Pinos Sooty Grouse[b, e]				X						
Catalina California Quail[b, e]								X		
Fork-tailed Storm-Petrel[b, c]	X									
Ashy Storm-Petrel[b, d, e]	x						X	X		
Black Storm-Petrel[b, d]								X		
American White Pelican[b, c]			X							
Least Bittern	x	x	x		x	x	x	x	x	X
Wood Stork[b, d]										X
Northern Harrier	x	X	X	x	X	X	X	x	x	
Northern Goshawk	X	X	x	X			x	x		
Yellow Rail (breeding)[b, c]		x	x							
Yellow Rail (wintering)	x				x		X	x		
Lesser Sandhill Crane					x	X				x
Snowy Plover (interior population)			X			X			X	X
Mountain Plover					x	X		x	x	X
Gull-billed Tern[b, d]								X		X
Black Tern		X	X	x	X	x				
Black Skimmer[b, d]							x	X		X
Cassin's Auklet	X						X	X		
Tufted Puffin[b, c]	X						X			
Burrowing Owl		x	x		x	X	x	x	x	X
California Spotted Owl[e]		x		X			x	X		
Long-eared Owl	x	X	X	x	x	x	x	x	x	x
Short-eared Owl	x	x	X		x	x	x		x	
Black Swift	X	X		X			X	X		
Vaux's Swift	X	X	x	x			x			
Olive-sided Flycatcher	X	X	X	X			X	X		
Vermilion Flycatcher								x	x	X
Loggerhead Shrike (mainland populations)	x	x	X	x	X	X	X	X	X	X
Island Loggerhead Shrike[b, e]								X		
Gray Vireo[b, d]								X	X	
Catalina Hutton's Vireo[b, e]								X		
Purple Martin	X	X	x	X	x		X	x		
San Diego Cactus Wren[b, e]								X		
Clark's Marsh Wren[b, e]								X		
Bendire's Thrasher[b, d]									X	x
Crissal Thrasher[b, d]									x	X
Le Conte's Thrasher (San Joaquin population)[b, d]						X				
Lucy's Warbler[b, d]									x	X
Yellow Warbler	X	X	X	X	x	x	x	X	x	
Sonora Yellow Warbler[b, d]										X
San Francisco Common Yellowthroat[b, e]							X			
Yellow-breasted Chat	X	X	x	x	x	x	x	x	x	x
Summer Tanager			x	X				x	X	x
San Clemente Spotted Towhee[b, e]								X		
Santa Cruz Island Rufous-crowned Sparrow[b, e]								X		
Oregon Vesper Sparrow (wintering)[e]					X	X	x	x		
Bryant's Savannah Sparrow[b, e]	X						X			
Large-billed Savannah Sparrow[b, d]								X		X

(*continued*)

Table 5 (*continued*)

Taxon	BCR 5		BCR 9	BCR 15	BCR 32				BCR 33	
	NW	CR	GB	SN	SV	SJV	CW	SW	MD	SD
Grasshopper Sparrow	x	x		x		x	X	X		
Song Sparrow ("Modesto" population)[b]					X	X				
Suisun Song Sparrow[b, e]							X			
Samuels Song Sparrow[b, e]							X			
Alameda Song Sparrow[b, e]							X			
Channel Island Song Sparrow[b, e]								X		
Kern Red-winged Blackbird[b, e]				X						
Tricolored Blackbird	x		x	x	X	X	x	x		
Yellow-headed Blackbird		x	X	x	x	x	x	x	x	X

[a]BCR 5, Northern Pacific Rainforest; BCR 9, Great Basin; BCR 15, Sierra Nevada; BCR 32, Coastal California; and BCR 33, Sonoran and Mojave Deserts (www.nabci-us.org/bcrs.html, U.S. NABCI Committee 2000; Figure 1). Geographic subdivisions (adapted from Hickman 1993, Figure 2) are: NW, Northwestern California; CR, Cascade Range; SN, Sierra Nevada; SV, Sacramento Valley; SJV, San Joaquin Valley; CW, Central Western California; SW, Southwestern California; MD, Mojave Desert; SD, Sonoran (Colorado) Desert. X, the geographic subdivision indicated supports a substantial portion of the taxon's population in California; x, the geographic subdivision indicated supports a low to modest portion of the taxon's population in California.

[b]Taxa with restricted distribution, i.e., occurring in only (or mainly) one or two major biogeographic regions.

[c]Taxa currently reaching the southern limit of their breeding range in northern or central California.

[d]Taxa currently reaching the northern limit of their breeding range or postbreeding range (Wood Stork, Large-billed Savannah Sparrow) in southern or central California.

[e]Taxa endemic or near-endemic in California (see Table 8).

Table 6 Severity of Known Historic and Current Threats in California Affecting Ranked Taxa on the List of California Bird Species of Special Concern[a]

Taxon	Habitat Loss[b]	Alien Species[b]	Pollution[b]	Over-exploitation[b]	Disease[b]
Fulvous Whistling-Duck	X			x	X
Tule Greater White-fronted Goose	X				
Brant	X				
Redhead	X			x	
Harlequin Duck	X		x	X	
Greater Sage-Grouse	X	X	x		
Mount Pinos Sooty Grouse	X				
Catalina California Quail	X	x			
Fork-tailed Storm-Petrel	X	X	x		
Ashy Storm-Petrel	X	X	x		
Black Storm-Petrel		X			
American White Pelican	X		X	x	X
Least Bittern	X				
Wood Stork	X		x		
Northern Harrier	X		x		
Northern Goshawk	X		x		
Yellow Rail	X	x			
Lesser Sandhill Crane	X			x	x
Snowy Plover (interior population)	X			x	
Mountain Plover	X				
Gull-billed Tern	x			X	
Black Tern	X	x			
Black Skimmer	X		x		
Cassin's Auklet		X	X	x	
Tufted Puffin	X		X		
Burrowing Owl	X		x		
California Spotted Owl	X				

(*continued*)

Table 6 (*continued*)

Taxon	Habitat Loss[b]	Alien Species[b]	Pollution[b]	Over-exploitation[b]	Disease[b]
Long-eared Owl	X				
Short-eared Owl	X				
Black Swift	x				
Vaux's Swift	X				
Olive-sided Flycatcher	X				
Vermilion Flycatcher	X				
Loggerhead Shrike (mainland populations)	X		x		
Island Loggerhead Shrike	X	X			
Gray Vireo	X				
Catalina Hutton's Vireo	X				
Purple Martin	X	X			
San Diego Cactus Wren	X				
Clark's Marsh Wren	X	X			
Bendire's Thrasher	X				
Crissal Thrasher	X	X			
Le Conte's Thrasher (San Joaquin population)	X	X			
Lucy's Warbler	X	X			
Yellow Warbler	X				
Sonora Yellow Warbler	X	X			
San Francisco Common Yellowthroat	X				
Yellow-breasted Chat	X				
Summer Tanager	X	X			
San Clemente Spotted Towhee	X	x			
Santa Cruz Island Rufous-crowned Sparrow	X	x			
Oregon Vesper Sparrow	X	x			
Bryant's Savannah Sparrow	X	X			
Large-billed Savannah Sparrow	X				
Grasshopper Sparrow	X	X			
Song Sparrow ("Modesto" population)	X	x			
Suisun Song Sparrow	X	x			
Samuels Song Sparrow	X	x			
Alameda Song Sparrow	X	x			
Channel Island Song Sparrow	X	x			
Kern Red-winged Blackbird	X	X			
Tricolored Blackbird	X		X		
Yellow-headed Blackbird	X		x		

[a]Severity of threats: X, a major realized threat known or strongly thought to have caused a substantial population decline or range retraction; x, a minor realized or potential threat that is not yet known or thought to have caused a substantial population decline or range retraction (see Methods).

[b]Categories of threats are those of Wilcove et al. (1998, 2000; see Methods); habitat loss also includes habitat degradation.

case for alien species (16 of 27), pollution (4 of 15), overexploitation (2 of 8), and disease (2 of 3).

Monitoring and Rangewide Surveys

Information presented in species accounts indicates that population trends of birds of special concern as a whole are poorly monitored. Of 56 special concern taxa with breeding populations in California, only 12 were adequately monitored in the state by the Breeding Bird Survey (Table 7). Another 4 breeding taxa are monitored annually or semiregularly by other methods or have de facto monitoring as a result of independent annual population censuses at all or most of their key nesting sites. The adequacy of these methods for detecting population trends, however, is unknown. Of the seven taxa of concern in the nonbreeding season, the Brant is the only one with an adequate program to monitor population trends. Three of the taxa of concern in the nonbreeding season are subspecies (the Tule Greater White-fronted Goose, Lesser Sandhill Crane, and Oregon Vesper Sparrow) that would need specialized monitoring

Table 7 Status of Monitoring Efforts and Rangewide Surveys for Ranked Taxa on the List of California Bird Species of Special Concern

Taxon	Breeding Bird Survey[a]	Other Monitoring Program[b]	Rangewide Population Survey[c]
Fulvous Whistling-Duck	**no**	no	no
Tule Greater White-fronted Goose	NA	no	yes
Brant	NA	yes	yes
Redhead	no	no	no
Harlequin Duck	**no**	no	no
Greater Sage-Grouse	no	yes	yes
Mount Pinos Sooty Grouse	no	no	no
Catalina California Quail	*no*	no	no
Fork-tailed Storm-Petrel	**no**	no	yes
Ashy Storm-Petrel	**no**	no	yes
Black Storm-Petrel	**no**	no	yes
American White Pelican	yes (*)	yes	yes
Least Bittern	**no**	no	no
Wood Stork	NA	no	*yes*
Northern Harrier	yes (*)	no	no
Northern Goshawk	no	no	no
Yellow Rail	**no**	no	no
Lesser Sandhill Crane	NA	no	no
Snowy Plover (interior population)	**no**	no	yes
Mountain Plover	NA	no	*yes*
Gull-billed Tern	**no**	*yes*	*yes*
Black Tern	no	no	yes
Black Skimmer	**no**	no	*yes*
Cassin's Auklet	**no**	no	yes
Tufted Puffin	**no**	no	yes
Burrowing Owl	yes (+)	no	yes
California Spotted Owl	**no**	yes	*yes*
Long-eared Owl	**no**	no	no
Short-eared Owl	**no**	no	no
Black Swift	no	no	no
Vaux's Swift	yes (*)	no	no
Olive-sided Flycatcher	yes (–)	no	no
Vermilion Flycatcher	**no**	no	no
Loggerhead Shrike (mainland populations)	yes (–)	no	no
Island Loggerhead Shrike	*no*	no	no
Gray Vireo	**no**	no	no
Catalina Hutton's Vireo	*no*	no	no
Purple Martin	yes (*)	no	yes
San Diego Cactus Wren	*no*	no	no
Clark's Marsh Wren	*no*	no	no
Bendire's Thrasher	no	no	yes
Crissal Thrasher	no	no	no
Le Conte's Thrasher (San Joaquin population)	*no*	no	no
Lucy's Warbler	**no**	no	no
Yellow Warbler	yes (*)	no	no
Sonora Yellow Warbler	*no*	no	no
San Francisco Common Yellowthroat	*no*	no	yes
Yellow-breasted Chat	yes (*)	no	no
Summer Tanager	no	no	no
San Clemente Spotted Towhee	*no*	no	no
Santa Cruz Island Rufous-crowned Sparrow	*no*	no	no
Oregon Vesper Sparrow	NA	no	no

(*continued*)

Table 7 (*continued*)

Taxon	Breeding Bird Survey[a]	Other Monitoring Program[b]	Rangewide Population Survey[c]
Bryant's Savannah Sparrow	*no*	no	no
Large-billed Savannah Sparrow	NA	no	no
Grasshopper Sparrow	yes (*)	no	no
Song Sparrow ("Modesto" population)	*no*	no	no
Suisun Song Sparrow	*no*	no	yes
Samuels Song Sparrow	*no*	no	yes
Alameda Song Sparrow	*no*	no	yes
Channel Island Song Sparrow	*no*	no	no
Kern Red-winged Blackbird	*no*	no	no
Tricolored Blackbird	yes (*)	yes	yes
Yellow-headed Blackbird	yes (*)	no	no

[a]Adequacy of the Breeding Bird Survey (BBS) for detecting trends in the California populations of each taxon are based on analyses for 1968 to 2004 (Sauer et al. 2005). Yes, if these authors assigned a "Regional Credibility Ranking" of yellow or blue (referred to here as medium and high); no, if they assigned a ranking of red (low). Such rankings are applied at the species level only. Population trends are reported if $P \leq 0.1$ (+, positive; –, negative; *, no positive or negative trend). There are two additional classes of inadequate data: **no**, no data reported for the species at all; *no*, a subspecies (or distinct population) is not, but the species as a whole is, well sampled in California. NA, does *not* breed in the state.

[b]Indicates whether other monitoring programs adequately assess trends of the entire California population of each taxon; monitoring of local populations only is not deemed adequate for a designation of "yes." Italics denote de facto monitoring such that censuses at individual sites can be added to obtain an estimate of the total nesting population; no mechanism is in place, however, to coordinate independent efforts or to ensure their long-term continuity. We do not consider the rangewide surveys of California seabirds that to date have been conducted twice (1975–1980, 1989–1991) as a monitoring program; see next footnote.

[c]Indicates whether rangewide surveys have been conducted for each taxon during the past 20 years. Such surveys may be attempts (not always successful) to directly census all or most of the statewide population; they may be estimates made by extrapolating sampled densities to the known or estimated total extent of suitable habitat. Italics denote a de facto survey such that censuses at individual sites, despite a lack of a prior coordination, can be added to obtain an estimate of the total nesting (or nonbreeding) population.

programs because of the difficulty of identifying these taxa in the field. Some other cryptic taxa, such as the Snowy and Mountain plovers, would need specialized monitoring schemes because of the difficulty of finding many individual birds. Some data are collected on numbers of Mountain Plovers in early winter in California by Christmas Bird Counts. These data, however, apparently are not adequate for trend assessment, and currently no up-to-date analyses are available for all species counted on CBCs (Sauer et al. 1996), in contrast to the regular updates of analyses of BBS data for breeding birds (Sauer et al. 2005).

At least 24 (38%) of the special concern taxa have been surveyed to determine population size throughout their California range in the past 20 years; many have never been surveyed in this manner (Table 7).

California Bird Responsibility List

One hundred twenty-five taxa qualified for a California Bird Responsibility List because all or a very high proportion of their global populations occur in the state (Table 8). Of these, 64 taxa are endemic, 54 near-endemic (>80% but <100% of entire range or population in California), and 7 semi-endemic (>50%–80% of entire range or population in California). Of the 18 species on the list, 3 are endemic (the California Condor, Island Scrub-Jay, and Yellow-billed Magpie), 8 near-endemic (the Ashy Storm-Petrel, Allen's Hummingbird, Nuttall's Woodpecker, Oak Titmouse, Wrentit, California Thrasher, Tricolored Blackbird, and Lawrence's Goldfinch), and 7 semi-endemic (the Brandt's Cormorant, Mountain Plover, Western Gull, White-headed Woodpecker, Le Conte's Thrasher, Hermit Warbler, and California Towhee). All the rest are endemic or near-endemic subspecies, demonstrating the very high rate of subspecific endemism in California and adjacent states. Twenty-one taxa occurred on both the (ranked) special concern and responsibility lists (Tables 1 and 8); 23 if the San Joaquin Le Conte's Thrasher (*Toxostoma lecontei macmillanorum*) and Modesto Song Sparrow (*Melospiza melodia mailliardi*) are considered valid subspecies. Co-occurrence on

the two lists indicates a particularly high level of conservation concern in California. Not only are these taxa declining or vulnerable, but also the concentration of their populations here indicates that conservation actions must focus particularly on California if they are to be successful.

Taxa to Watch

We identified an additional 31 taxa, not included on the special concern list, as "Taxa to Watch" on the basis of prior concern for the well-being of their populations in California (Appendix 1).

Table 8 California Bird Responsibility List: Endemics, Near-Endemics, and Semi-Endemics

Endemics (EN score = 10; 64 taxa)	
Tule Greater White-fronted Goose	(*Anser albifroms elgasi*)
Mount Pinos Sooty Grouse	(*Dendragapus fuliginosus howardi*)
Little San Bernardino Mountain Quail	(*Oreortyx pictus russelli*)
Coast California Quail	(*Callipepla californica brunnescens*)
Inyo California Quail	(*Callipepla californica canfieldae*)
Catalina California Quail	(*Callipepla californica catalinensis*)
California Condor[b, c]	(*Gymnogyps californianus*)
California Clapper Rail[b, c]	(*Rallus longirostris obsoletus*)
California Spotted Owl	(*Strix occidentalis occidentalis*)
Nonmigratory Allen's Hummingbird	(*Selasphorus sasin sedentarius*)
Southern White-headed Woodpecker	(*Picoides albolarvatus gravirostris*)
Island Pacific-slope Flycatcher	(*Empidonax difficilis insulicola*)
Island Loggerhead Shrike	(*Lanius ludovicianus anthonyi*)
San Clemente Loggerhead Shrike[b]	(*Lanius ludovicianus mearnsi*)
Parkes's Hutton's Vireo	(*Vireo huttoni parkesi*)
Sierra Hutton's Vireo	(*Vireo huttoni sierrae*)
Monterey Hutton's Vireo	(*Vireo huttoni huttoni*)
Catalina Hutton's Vireo	(*Vireo huttoni unitti*)
Island Scrub-Jay	(*Aphelocoma insularis*)
Eagle Mountain Western Scrub-Jay	(*Aphelocoma californica cana*)
Yellow-billed Magpie	(*Pica nuttalli*)
Sierra Horned Lark	(*Eremophila alpestris sierrae*)
Island Horned Lark	(*Eremophila alpestris insularis*)
Ruddy Horned Lark	(*Eremophila alpestris rubea*)
Marin Chestnut-backed Chickadee	(*Poecile rufescens neglectus*)
Santa Cruz Chestnut-backed Chickadee	(*Poecile rufescens barlowi*)
California Oak Titmouse	(*Baeolophus inornatus inornatus*)
Little San Bernardino Oak Titmouse	(*Baeolophus inornatus mohavensis*)
Little San Bernardino Bushtit	(*Psaltriparus minimus sociabiliis*)
Monterey Pygmy Nuthatch	(*Sitta pygmaea pygmaea*)
Phillips's Brown Creeper	(*Certhia americana phillipsi*)
Nicasio Bewick's Wren	(*Thryomanes bewickii marinensis*)
Vigors's Bewick's Wren	(*Thryomanes bewickii spilurus*)
San Clemente Bewick's Wren[d]	(*Thryomanes bewickii leucophrys*)
Clark's Marsh Wren	(*Cistothorus palustris clarkae*)
California Swainson's Thrush	(*Catharus ustulatus oedicus*)
Ruddy Wrentit	(*Chamaea fasciata rufula*)
Monterey Wrentit	(*Chamaea fasciata fasciata*)
Northern California Thrasher	(*Toxostoma redivivum sonomae*)
San Joaquin Le Conte's Thrasher	(*Toxostoma lecontei macmillanorum*)
San Francisco Common Yellowthroat	(*Geothlypis trichas sinuosa*)
San Francisco Spotted Towhee	(*Pipilo maculatus falcifer*)
San Clemente Spotted Towhee	(*Pipilo maculatus clementae*)
Sacramento California Towhee[e]	(*Pipilo crissalis carolae*)
Inyo California Towhee[c, e, f]	(*Pipilo crissalis eremophilus*)
San Francisco California Towhee	(*Pipilo crissalis petulans*)
Vigors's California Towhee	(*Pipilo crissalis crissalis*)
California Rufous-crowned Sparrow	(*Aimophila ruficeps ruficeps*)

(*continued*)

Table 8 (*continued*)

Santa Cruz Island Rufous-crowned Sparrow	(*Aimophila ruficeps obscura*)
San Clemente Sage Sparrow[e, f]	(*Amphispiza belli clementeae*)
Bryant's Savannah Sparrow	(*Passerculus sandwichensis alaudinus*)
Yolla Bolly Fox Sparrow[e]	(*Passerella iliaca brevicauda*)
Marin Song Sparrow	(*Melospiza melodia gouldii*)
Suisun Song Sparrow	(*Melospiza melodia maxillaris*)
Samuels Song Sparrow	(*Melospiza melodia samuelis*)
Alameda Song Sparrow	(*Melospiza melodia pusillula*)
Channel Island Song Sparrow	(*Melospiza melodia graminea*)
Nuttall's White-crowned Sparrow	(*Zonotrichia leucophrys nuttalli*)
Point Pinos Dark-eyed Junco	(*Junco hyemalis pinosus*)
San Francisco Red-winged Blackbird	(*Agelaius phoeniceus mailliardorum*)
California Red-winged Blackbird	(*Agelaius phoeniceus californicus*)
Kern Red-winged Blackbird	(*Agelaius phoeniceus aciculatus*)
Sierra Nevada Gray-crowned Rosy-Finch	(*Leucosticte tephrocotis dawsoni*)
California Pine Grosbeak	(*Pinicola enucleator californica*)
Near-Endemics (EN score = 7.5; 54 taxa)	
Aleutian Cackling Goose	(*Branta hutchinsii leucopareia*)
Southern California Mountain Quail	(*Oreortyx pictus eremophilus*)
Ashy Storm-Petrel	(*Oceanodroma homochroa*)
Red-bellied Red-shouldered Hawk	(*Buteo lineatus elegans*)
California Black Rail[g]	(*Laterallus jamaicensis coturniculus*)
Light-footed Clapper Rail[b, c]	(*Rallus longirostris levipes*)
Yuma Clapper Rail[b, g]	(*Rallus longirostris yumanensis*)
Alaska Marbled Godwit	(*Limosa fedoa beringia*)
California Western Screech-Owl	(*Otus kennicottii bendirei*)
Pacific Great Horned Owl	(*Bubo virginianus pacificus*)
Dusky Common Poorwill	(*Phalaenoptilus nuttallii californicus*)
Allen's Hummingbird	(*Selasphorus sasin*)
Migratory Allen's Hummingbird	(*Selasphorus sasin sasin*)
California Acorn Woodpecker	(*Melanerpes formicivorus bairdi*)
Sierra Red-breasted Sapsucker	(*Sphyrapicus varius daggetti*)
Nuttall's Woodpecker	(*Picoides nuttallii*)
Cabanis's Hairy Woodpecker	(*Picoides villosus hyloscopus*)
California Horned Lark	(*Eremophila alpestris actia*)
Mohave Horned Lark	(*Eremophila alpestris ammophila*)
Bailey's Mountain Chickadee	(*Poecile gambeli baileyae*)
Oak Titmouse	(*Baeolophus inornatus*)
California Bushtit	(*Psaltriparus minimus californicus*)
San Diego Cactus Wren	(*Campylorhynchus brunneicapillus sandiegensis*)
Dotted Canyon Wren	(*Catherpes mexicanus punctulatus*)
Muir's Winter Wren	(*Troglodytes troglodytes muiri*)
Central California Winter Wren	(*Troglodytes troglodytes obscurior*)
Suisun Marsh Wren	(*Cistothorus palustris aestuarinus*)
Alta California Gnatcatcher[f]	(*Polioptila californica californica*)
Sierra Hermit Thrush	(*Catharus guttatus sequoiensis*)
Wrentit	(*Chamaea fasciata*)
Pallid Wrentit	(*Chamaea fasciata henshawi*)
California Thrasher	(*Toxostoma redivivum*)
Southern California Thrasher	(*Toxostoma redivivum redivivum*)
Dusky Orange-crowned Warbler	(*Vermivora celata sordida*)
Sacramento Spotted Towhee	(*Pipilo maculatus falcinellus*)
San Diego Spotted Towhee	(*Pipilo maculatus megalonyx*)
California Black-chinned Sparrow	(*Spizella atrogularis cana*)
Oregon Vesper Sparrow (wintering)	(*Pooecetes gramineus affinis*)
Intermediate Sage Sparrow	(*Amphispiza belli canescens*)
Bell's Sage Sparrow	(*Amphispiza belli belli*)

(*continued*)

Table 8 (*continued*)

Alberta Fox Sparrow (wintering)	(*Passerella iliaca altivagans*)
Shumagin Fox Sparrow (wintering)	(*Passerella iliaca unalaschcensis*)
Kodiak Fox Sparrow (wintering)	(*Passerella iliaca insularis*)
Yakutat Fox Sparrow (wintering)	(*Passerella iliaca annectens*)
Olivaceous Fox Sparrow (wintering)	(*Passerella iliaca olivacea*)
Stephens's Fox Sparrow	(*Passerella iliaca stephensi*)
Mendocino Song Sparrow	(*Melospiza melodia cleonensis*)
Heermann's Song Sparrow	(*Melospiza melodia heermanni*)
Sierra Nevada Dark-eyed Junco	(*Junco hyemalis thurberi*)
California Blue Grosbeak	(*Guiraca caerulea salicaria*)
Tricolored Blackbird	(*Agelaius tricolor*)
San Clemente House Finch	(*Carpodacus mexicanus clementis*)
Lawrence's Goldfinch	(*Carduelis lawrencei*)
Willow American Goldfinch	(*Carduelis tristis salicamans*)
Semi-endemics (EN = 5; 7 species)[h]	
Brandt's Cormorant	(*Phalacrocorax penicillatus*)
Mountain Plover (wintering)	(*Charadrius montanus*)
Western Gull	(*Larus occidentalis*)
White-headed Woodpecker	(*Picoides albolarvatus*)
Le Conte's Thrasher	(*Toxostoma lecontei*)
Hermit Warbler	(*Dendroica occidentalis*)
California Towhee	(*Pipilo crissalis*)

[a]Taxa are arranged taxonomically within each section; boldfaced taxa are also on the ranked portion of the BSSC List.
[b]Federally endangered.
[c]State endangered.
[d]Extinct.
[e]Validity of subspecies suspect (P. Unitt pers. comm.).
[f]Federally threatened.
[g]State threatened.
[h]This category includes only full species.

Discussion

Units of Conservation

Taxonomic concepts and hence the units considered for conservation are not stable, and even what constitutes a species is much debated (e.g., Rojas 1992, Peterson 1998, Sangster 2000 and references therein). There is even more disagreement as to what lower taxonomic levels (subspecies, "distinct population segments," "evolutionarily significant units") should be the focus of conservation efforts (e.g., Ryder 1986, Moritz 1994, Pennock and Dimmick 1997, Waples 1998, Crandall et al. 2000, DeWeerdt 2002, Zink 2004). Presumably because of these uncertainties, most lists developed for conservation prioritization focus on species (Appendix 2), despite the fact that many subspecies of birds have been listed as threatened or endangered at the state and federal level (see Haig et al. 2006). Given the widespread concern for the loss of both species and the genetic diversity within them, a focus solely on species is likely to be shortsighted. Populations are being lost worldwide at a much more rapid rate than are species (Hughes et al. 1997), and many subspecies undoubtedly contain novel adaptations that may be necessary to meet future environmental challenges (Crandall et al. 2000). Zink (2004), however, suggested that 97% of continentally distributed avian subspecies lack population genetic structure sufficient to be considered evolutionarily significant units, and thus the use of current subspecies designations is misleading conservation efforts. By contrast, Phillimore and Owens (2006) reported that at least 36% of the subspecies of birds they sampled worldwide represented distinct phylogenetic lineages. They opined that avian subspecies often provide a shortcut for estimating patterns of intraspecific genetic divergence and hence may serve as a useful tool for conservation.

Peripheral Populations

The primary arguments against paying special conservation attention to peripheral populations are that such efforts have little probability of success, given the marginal viability of populations at the edge of their range, and that it results in an allocation of funds out of proportion to need (Hunter and Hutchinson 1994, Peterson 2001). Likewise, many common bird species in North America undergoing declines have done so predominantly where abundances are highest, suggesting conservation efforts should focus on these high-abundance areas (Rodríguez 2002). Conversely, protecting peripheral populations may preserve genetic diversity that allows a population to shift its range in response to climate change, maintain the integrity of local ecosystems, assist many other species using the same habitat, and aid conservation on a broader scale by keeping taxa from reaching global endangerment (Hunter and Hutchinson 1994, Nielsen et al. 2001). Also, the protection of any population is a value judgment, and people and organizations, particularly those organized along political boundaries, are more apt to feel protective of local resources and to act locally in their defense. Conservation of peripheral populations in California may be particularly important when their ranges extend into Mexico or adjacent states that lack appropriate legislation or regulatory mechanism to protect at-risk species (see Abbitt et al. 2000). California, one of the most biologically diverse states, should protect all of its well-established populations, whether widespread, centrally clustered, or at the margins of the state.

Care must be taken in classifying "peripheral populations," as this is not always straightforward and risks marginalizing taxa that warrant protection (Nielsen et al. 2001). For example, two breeding species in California that currently can be classified as "peripheral"—the American White Pelican and Fulvous Whistling-Duck—were not always so restricted in range in the state. The pelican and the whistling-duck, now confined as breeders, respectively, to the northern margin of the state in the Klamath Basin and the southern margin in the Imperial Valley, once overlapped broadly in breeding distribution in south-central and southern California (see accounts). Hence their current peripheral status is the result of large-scale retractions of their ranges, which should be vigorously protected against further erosion. The standard of considering for special concern status only taxa with well-established populations in the state should counter any concerns that conservation efforts for peripheral populations will have little chance for success. Clearly, protection of well-established peripheral populations should help stem range retractions that would lead to further reduction of California's avian biodiversity.

Elusiveness of a Perfect Ranking Approach

In recent years, objective ranking schemes have been embraced as an important tool in conservation. In providing a scientific basis for identifying and highlighting at-risk taxa, they may reduce unpredictable biases from subjective expert input, make the logic behind assessments explicit, call attention to factors causing endangerment, support regulatory protection of taxa, constrain development and exploitation, and provide input into prioritization of conservation programs (Keith et al. 2004, O'Grady et al. 2004a). The proliferation of schemes reflects in part the different purposes and scales for which they are designed and applied.

Although there have been few comparisons of various ranking systems applied at different scopes and scales, it appears that the highest correspondence is found in the taxa identified in the highest or lowest categories of the respective systems (Mehlman et al. 2004, O'Grady et al. 2004a). If this pattern prevails in additional comparisons, it will be a bit troubling, as the taxa in the highest categories may already have been identified and listed as endangered and the ones in the lowest categories have a lower priority for conservation. What is needed is accurate prediction of those intermediate taxa that are most at risk of endangerment if current declines and threats continue. Some of the best predictors of extinction risk appear to be current population size and population trend (O'Grady et al. 2004b); systems using information on current and future threats are the most useful in identifying species that will be adversely affected by proposed management actions (Andelman et al. 2004).

Much of the difference in the correspondence of various categorization systems may justifiably reflect the purposes for which they are designed, in response to the different scales (time and space), the proposed management scenarios, or the ecological or political settings in which they were created (Andelman et al. 2004, O'Grady et al. 2004a). Common to all systems is the major problem of data scarcity in categorizing species. Still, many systems have serious defects, which vary among these systems, hence the recommendation that various countries use the same system or, at least, compatible ones (de Grammont and Cuarón 2006).

Disagreement over the type of scheme to use when the purpose and scale are the same (cf. Beissinger et al. 2000, Carter et al. 2000) appears to reflect the elusiveness of designing a system that can accurately measure the risks of extinction for a host of birds, each with unique ecological attributes, particularly given great variation in the knowledge of biological variables both within and across taxa. The problem of comparing oranges and apples is compounded manifold when extending the comparison from alcids to accipiters, bitterns to blackbirds, storm-petrels to swifts, and woodpeckers to wood-warblers. Consequently, virtually any ranking scheme has shortcomings.

Beissinger et al. (2000) argued for the use of a categorical rather than linear approach to ranking the conservation priority of birds in North America. They considered the appeal of linear ranking schemes to be the ease with which variables can be defined and the quantitative results with superficially unambiguous implications for management priorities. They listed major shortcomings of linear schemes to be that (1) incomplete data make it difficult to choose variables and to decide whether all should be weighted equally; (2) unintentional weighting can occur because of multicolinearity (or correlations) among variables; and (3) a lack of knowledge often exists about the relative relationships between different scores for each variable and the probability of extinction. In the third case, assigning scores for use in linear ranking presumes the same relationship to the probability of extinction for (1) the same value for the same variable for two different species and (2) the same value for two different variables for the same or different species. For example, in the former case a presumption would be that a species of warbler and a species of hawk both with population sizes of 2000 would have the same probability of going extinct on the basis of abundance. In fact, because of the energetics of body size, a certain extent of habitat would likely support far fewer hawks than warblers, and hence a population of 2000 might represent the maximum population size attainable for a hawk but a much depleted one for a warbler. In the case of (2), it is hard to imagine that the same scores for different variables would always bear the same relationship to the probability of extinction both for the same species and for different species.

Like Beissinger et al. (2000), we found many and strong correlations among the scores for criteria used to score potentially at-risk taxa (Table 3). In a similar analysis of scores for biological variables for Florida vertebrates, Millsap et al. (1990) found strong correlations between population size and range size and between population trend and

distribution trend. Carter et al. (2000) countered that in their analysis comparing categorical and linear rankings of breeding bird species in New York State that Beissinger et al. (2000) found a strong correlation between categorical rank and the sum of the seven variables, and that both approaches identified the same species of greatest conservation concern. Carter et al. (2000) further judged that high scores for a species on multiple parameters (and thus high total scores) are compounding evidence of vulnerability. Still, the summing of scores in a linear scheme, to produce a list of taxa ranked in descending order from those with the highest to the lowest scores, gives a false sense of precision given the uncertainty of biological data and the difficulties of comparing across species with widely varying ecological characteristics. Linear schemes also suffer from the need to choose an arbitrary cutoff between the scores separating inclusion on (versus exclusion from) the list. This arbitrariness is compounded if the list is subdivided further into differing levels of conservation priority.

Categorical schemes have been criticized as being vague (Given and Norton 1993). Also, although they identify taxa both for inclusion on a list and within levels of priority based solely on one or a few criteria scores, the setting of the criteria that discriminate among categories is typically defined arbitrarily. Similarly, the difficulties of incomplete data presented above for linear schemes also apply to categorical ones.

Recognizing the limitations and strengths of both linear and categorical approaches to ranking birds for conservation concern, we ultimately ranked taxa in California using both approaches. When combining the results of both systems to produce a list with three levels of conservation priority, we gave each taxon the higher, rather than lower, of the priority rankings assigned by the two approaches. This was judged the best and most conservative approach; if mistakes were made it seemed better to rank (recommend) a taxon for too much conservation priority rather than for too little. The use of two approaches also yielded a list with more taxa than would have been the case if only one of the schemes had been used. Again, we judged it more conservative to assign conservation priority to slightly more versus less taxa. Along similar lines, PIF has recently begun to use "Priority Species Pools" (including tiers) to highlight species most in need of conservation attention, using a combination of linear scores and categories (Panjabi 2001).

Arbitrariness

No matter how carefully any ranking system is crafted, there will always be elements that can be considered arbitrary. For example, in the present system there is no magic formula for determining the numerical cutoff point between the various categories in the population size criterion because we knew of no way to set biologically meaningful or demonstrably superior cutoff points. These categories vary by multiples of 10, but there is no reason why they couldn't have been chosen instead to be multiples of 5, 7, 20, or some other number. Regardless of what multiples are chosen, cutoffs exhibit further arbitrariness. For example, the population size of two taxa may differ by only one individual (e.g., 999 and 1000) but still get a different score for the population size criterion (10 versus 7.5), though such a slim difference is unlikely to be a relevant predictor of the differential likelihood of the two taxa becoming extirpated in the state in the future. Conversely, it is not possible to have a series of mutually exclusive categories along a continuum of values without having sharp breaks between them. Still, because the categories are broad and information on the population sizes of many taxa are poorly known, we judged the approach taken was reasonable and generally consistent with that used for the scoring of comparable criteria in other ranking systems (e.g., Brown et al. 2000, Kushlan et al. 2002).

Other criteria were defined using similarly arbitrary values. Take the population trend and range trend criteria, which were estimated on the basis of changes from 1944 to the present. This period of measurement is, of course, arbitrary, but then so would have been any other. Under the period selected, some species would be handicapped in the scoring process if their populations declined or their range retracted substantially prior to rather than after 1944. Numbers of the Common Murre (*Uria aalge*) on the Farallon Islands were reduced by several hundred thousand from the mid-19th to early 20th centuries by commercial egg collecting (Ainley and Lewis 1974), and the species was extirpated from the Channel Islands sometime between 1913 and 1944 (Carter 2001). Hence, in scoring nominee taxa, neither the population decline nor the extirpation of the murre were considered because both occurred prior to 1944. If the criteria had been modified to set a period of measurement to accommodate the murre or other species with similar histories, it likely would have just shifted the bias to other species rather than eliminating it entirely. In choosing such a period,

there appear to be some temporal biases that affect most species in a like manner but change over time. For example, scores for population and range trend based on a period including the distant past might be expected to be less accurate than those for a more recent period, when typically more information is available, whereas the effects of habitat loss and other threats on species' populations and ranges likely average greater in recent decades. These patterns reflect a progressive increase in ornithological study paralleling generally greater impacts on birds with the ongoing expansion of the human population and advances in technology.

Although arbitrary, the 1944 cutoff date does have advantages over others. This date was chosen because it corresponded to Grinnell and Miller's (1944) seminal book on the status and distribution of California birds. This was the first book, and it is still the only one, though it is now out of date, to accurately describe the relative abundance, distribution, historic trends, and habitat needs of all of the state's birds. Thus it is a convenient benchmark with which to gauge subsequent trends, even though knowledge at the time of its publication, as now, was not uniform across all species. Although much ecological damage from human activities occurred before 1944, this date corresponds with a relative lull before the great human population boom and attendant impacts that began in California shortly after World War II. Thus the period from 1944 to the present is a good period for gauging the modern-day effects of humans on the state's birds and habitats.

Other ranking schemes take a similar modern-day approach to gauging conservation concern. In ranking vertebrates in Florida, Millsap et al. (1990) gauged scores for population trend on patterns over the past 20 years, though one of the categories gave higher scores for a population that formerly experienced declines but was currently stable or increasing than for one with a comparable current trend but no prior record of declines. PIF's assessment process for conservation of landbirds in the United States bases scores for "Relative Abundance," "Population Trend," and "Area Importance" primarily on analyses of BBS data (Carter et al. 2000, Panjabi 2001, Panjabi et al. 2005), which are available for the period from 1966 to the present. When BBS data are unavailable, the PIF system substitutes other information (e.g., Christmas Bird Count data, expert opinion), and "all changes in population size are assessed over a 30-year period" (Panjabi 2001). Although most CBC data are available online (www.audubon.org/bird/cbc/), rigorous analyses of broad-scale patterns are currently available for the period 1959–1988 only (Sauer et al. 1996).

Subjectivity

Any so-called objective ranking system will still have subjective elements. In many cases, this will follow directly from limited knowledge, which will force a categorization on the basis of poor (anecdotal or indirect) or no data on a taxon's status or limiting factors. In almost any system, including the present one, the threats criterion is surely the most subjective (see Beissinger et al. 2000). This stems from a lack of knowledge of how much effect various threat factors currently are having on a particular taxon, compounded with the great difficulty of predicting the future course of events on the basis of present knowledge, which is the essence of our threat criterion at least. Still, the threats facing each taxon are the best indicator of the likelihood it will decline and ultimately face extirpation in the state, and hence must be evaluated, even if somewhat subjectively. Evaluation in this manner will likely continue indefinitely, as knowledge will always be limited and prediction of the future will remain risky. In this regard, refining techniques to track the population trends and distribution of all taxa will be beneficial, as "a demonstrated long-term negative population trend often is a more reliable cue that a species is in trouble than is information on known or theoretical threats" (Beissinger et al. 2000, p. 554). In the meantime, assessment of threats should be done cautiously to guard against either over- or underestimating the future effect of threats. Likewise, biologists should be circumspect when evaluating population trends, as in some cases declining trends may reflect plant succession and a return of bird numbers to lower levels representative of conditions before human activities altered their habitat (Beissinger et al. 2000).

Uncertainty

Uncertainty is a pervasive feature in all attempts to discern the truth about natural systems but is one not easily remedied (Regan et al. 2002). Akçakaya et al. (2000) concluded that any classification of conservation status involves several types of uncertainty: semantic (use of inexact definitions), measurement error (lack of precise information on some or most variables), and natural variability (temporal and spatial variation in population size and distribution). Objective ranking systems typically attempt to reduce the

uncertainty in the prioritization of species for conservation by giving scores for multiple biological criteria, defining criteria exactly, and gathering all available data. Despite the best of efforts, some or all forms of uncertainty will remain.

Various approaches have been taken to accommodate uncertainty. The IUCN (2001, Annex 1) provided general guidelines for how assessors should handle uncertainty when assigning criteria scores, including ways to handle attitudes toward risk and uncertainty. As a last resort, they provided a category of "Data Deficient," that is, data are inadequate to determine the degree of threat faced by a taxon. Some ranking systems have designed one or more criteria such that a taxon is given a higher score of concern if there is uncertainty about the actual value for a criterion. For example, the PIF prioritization system links each population trend score with a supplemental score that assesses the quality of BBS data (Carter et al. 2000). In cases where the supplemental score leads to a categorization of "trend uncertain," the species is given a higher score than one known to be stable. The reasoning is that it is more conservative to weight the score toward the assumption the species might be declining rather than that it might be stable or increasing. PIF formerly assigned data quality scores to their "threats to breeding" and "threats to nonbreeding" criteria but dropped them, apparently because they were rarely used or caused confusion (Carter et al. 2000). Beissinger et al. (2000) recommended that PIF add a "separate overall uncertainty variable [that] would be helpful in assessing confidence in species' ranks and would assist in identifying research needs."

Knowledge of uncertainty can be useful in prioritizing management and research activities. For vertebrates in Florida, Millsap et al. (1990) ranked all taxa for a set of "action variables" as well as biological variables. The former scored taxa for the amount of knowledge available on distribution, population trend, and population limitations in Florida and also for the extent of ongoing management activities for these taxa in the state. In selecting priority taxa for management or research, they considered only taxa known or suspected to be declining. Then, taxa for which current knowledge of these action variables was adequate were considered strong candidates for management activities, and those for which limiting factors were poorly known were considered strong candidates for research.

The BSSC ranking system incorporates uncertainty in a limited fashion, but the species accounts in this document provide much information about the degree of knowledge available on special concern taxa. The population trend and range trend criteria incorporate uncertainty in a minor way by giving taxa whose populations or ranges are designated as "suspected of having been reduced but trend unknown" an equivalent score to ones for which there is evidence that these parameters are "slightly reduced," and a higher score than ones whose populations or ranges are known to be "stable or increasing." Suspicion of such trends, however, must be based on some biological knowledge of at least an anecdotal nature. We assessed the level of monitoring being conducted for all special concern taxa (Table 7), and the amount of knowledge available for scoring each of the seven criteria is presented in the species accounts, which also make recommendations for management, monitoring, and research needs.

Refinement of Ranking Schemes

Because of the uncertainty factors discussed above, there is pressure to refine ranking schemes to make them more biologically accurate and relevant to conservation. Refinement may involve improving the definitions of individual criteria, adding new criteria, or fine tuning the ranking system that uses the criteria scores to prioritize taxa for conservation. Examples of ongoing refinement are the ranking systems of the IUCN (e.g., IUCN 1994, 2001, 2006) and PIF (Carter et al. 2000, Panjabi 2001, Panjabi et al. 2005). There also is an extensive literature on ways to improve ranking systems (e.g., Todd and Burgman 1998, Colyvan et al. 1999, Akçakaya et al. 2000, de Grammont and Cuarón 2006). We suspect that some of these suggestions have not been widely adopted because they would be difficult to apply to a long list of taxa and may require sophisticated mathematical knowledge, or simply because of resistance to change once a particular system is in place. Although a good ranking system must address ecological complexity, it seems that to be widely used it must be relatively straightforward to understand and apply (especially by resource managers). Some practical suggestions for refining ranking protocols include providing training in their application, incorporating uncertainty in parameter estimates, and using consensus among multiple assessors (Keith et al. 2004).

During its deliberations to develop the present system, the technical advisory committee evaluated and rejected various additional criteria used by other ranking systems. For example, some systems include a criterion for "taxonomic (or

phylogenetic) uniqueness," which places value on preserving unique lineages by, for example, giving a higher score to a lone representative of a monotypic family than for a race of a geographically widespread species or for a species within a diverse genus (see Beissinger et al. 2000). The advisory committee rejected such a criterion because it was considered *not* to be a core measure of a taxon's risk or likelihood of extirpation in the state but rather a *value* judgment of what taxonomic entities were more deserving of protection. Although rejecting the criterion as part of the ranking scheme, the advisory committee noted that various additional factors, including this criterion, could be used as further screens for prioritization on top of the primary ranking scheme (see below). This parallels the distinctions made by Millsap et al. (1990). They scored taxa for five supplemental variables, including "systematic significance of taxon," but did not use them to rank taxa for setting conservation priorities. Rather they used these variables to "answer specific biological and political questions."

Other criteria used by some ranking systems include "ecological specialization" (Millsap et al. 1990) or "habitat specificity" (Reed 1992). Although a majority of the advisory committee initially favored the inclusion of scores for "ecological specialization," we ultimately rejected this criterion because of our inability to define categories of specialization that would be objective to apply. Whereas Millsap et al. (1990) judged that an ecological specialization criterion was needed to measure vulnerability to environmental change, some advisory committee members judged that any such specialization or vulnerability would be taken into account in the scoring of the threats criterion (on the assumption that, all else being equal, specialized taxa would be more likely than generalists to be affected by threats) or reflected in the scores for population trend and range trend (assuming that specialists are the most likely to experience declines). Beissinger et al. (2000) recommended the inclusion of an ecological specialization criterion as one of several potential refinements to the PIF ranking system.

Comparison with 1978 List

Comparison of the 1978 list of birds of special concern with the current one is difficult because the former was derived subjectively, the latter via an objective ranking scheme. Still, there are some obvious explanations for why these lists differ (Appendix 2). The major reasons for the changes since 1978 are the removal of various taxa because of their listing as state threatened or endangered, the addition of more subspecies to the current list, changes in the status of various species in the intervening years, and the change in methods for deriving the list. Since 1978, eight taxa on the original special concern list have been listed as state threatened (the Swainson's Hawk, Greater Sandhill Crane, and Bank Swallow) or endangered (the Marbled Murrelet, Gila Woodpecker, Gilded Flicker [formerly a subspecies of the Common Flicker], Willow Flycatcher [all California subspecies], and Arizona Bell's Vireo). One species not on the 1978 list, the Xantus's Murrelet, was scored and placed on the recent draft list but was subsequently removed because it was listed as state threatened before the draft special concern list was made final. In 2000, the Short-tailed Albatross was listed as federally endangered. Hence by the present definition it qualified for special concern status as a federally, but not state, listed taxon; prior to that it would have qualified as a species that had been extirpated from California waters in its primary seasonal role. The 1978 list included two subspecies in the "highest priority" category, but explicitly excluded consideration of any subspecies for inclusion in the other two priority categories (Remsen 1978). As noted above, the two subspecies on the 1978 special concern list have both since been listed as state endangered. Still, 24 subspecies have been added to the special concern list from 1978 to the present (Table 1 and Appendix 2).

Reasons for other changes in the list since 1978 are less clear because it is not certain what would have been included on the 1978 list if it had used the same objective ranking criteria as used for the current list. In some cases, the ability to evaluate some taxa has been enhanced since 1978 by the recent availability of more or higher quality data (e.g., the Black Tern, Shuford et al. 2001). Regardless, the following species included on the 1978 but not the current list have all experienced recent population increases in California: the Double-crested Cormorant (Carter et al. 1992), White-faced Ibis (Shuford et al. 1996, Earnst et al. 1998), Osprey (Gould and Jurek 1988), Cooper's Hawk (California county atlas data), Merlin (A. Fish/Golden Gate Raptor Observatory unpubl. data), and Rhinoceros Auklet (Carter et al. 1992, McChesney et al. 1995). In addition to its increasing numbers, the California Gull was not included on the current list because the main threat to the breeding population was reduced by a state water board order that will maintain lake levels at Mono Lake that will protect the state's

largest colony from ground predators (Shuford and Ryan 2000, Strong et al. 2004). The following taxa were added to the current list in part because of substantial recent population declines or range retractions in California: the Wood Stork, Mountain Plover, Olive-sided Flycatcher, Grasshopper Sparrow, and Tricolored Blackbird (see accounts). It is likely, however, that the reason that a large number of the 22 other taxa that were either removed from (12) or added to the list (10) from 1978 to the present was solely the application of the new ranking scheme. Thus, on biological grounds there may not have been much of a change in the conservation status of these taxa since 1978. Among those removed are six taxa (the Laughing Gull, Brown-crested Flycatcher, Virginia's Warbler, Hepatic Tanager, Gray-headed Junco, and Northern Cardinal) that reach the edge of their range in California. These taxa have either increased in population size (or colonized California) since the publication of Grinnell and Miller (1944), occur in such small numbers that their fate is likely greatly influenced by the dynamics of breeding populations in Arizona or Nevada (thus unlikely to benefit much from conservation efforts in California), or face no substantial threats to their well-being (see Appendix 1).

Habitat and Geographic Patterns

The high representation of special concern taxa within wetlands, scrublands, grasslands, and riparian forests (Table 4) is not surprising given these are the habitats with the highest rates of loss in California. Estimates indicate that California has lost over 90% of its original wetlands (Dahl et al. 1991), 95% of its riparian habitat (RHJV 2004), and 60% of its grasslands (CalPIF 2000). Although authors frequently emphasize these high rates, these percentages hide the true extent and complexity of the loss both in terms of structure and function. Degradation and fragmentation can have profound effects on biodiversity (Saunders et al. 1991, Debinski and Holt 2000). Among the greatest losses of ecosystem function affecting birds in California is that of our natural hydrology, which before human intervention greatly enhanced biological productivity both in space and time. The periodic flooding of areas such as the Central Valley and lower Colorado River valley formerly formed a diverse mosaic of permanent and ephemeral wetland and riparian habitats that depended on such perturbations for renewal (Rosenberg et al. 1991, Shuford et al. 2001). Restoring natural function to such habitats will be among the greatest conservation challenges in the state, though models exist for ways to meet human needs and also conserve the ecological integrity of riverine ecosystems (Richter and Richter 2000). Fortunately, efforts to conserve birds in the habitats mentioned have greatly increased recently via joint ventures and regional working groups of the North American Waterfowl Management Plan (e.g., USFWS 1990, CVJV 2006), U.S. Shorebird Conservation Plan (Brown et al. 2001, Hickey et al. 2003), and various California PIF bird conservation plans (e.g., CalPIF 2000, 2002; RHJV 2004).

The conservation of biodiversity in California faces great challenges because regions of the state with high numbers of special concern taxa (Table 5) also have the highest human population densities and projected future growth rates. From 1980 to 2003, California led all states in absolute coastal population growth, adding 9.9 million people to coastal areas, and ranked sixth in percent increase (47%) in coastal population (Crossett et al. 2004). In 2003, Los Angeles, Orange, and San Diego counties, respectively, were the first, fourth, and fifth most populous counties in the United States. Of the 10 coastal counties in the nation that experienced the greatest increases in population from 1980 to 2003, 6 were in California. Projections indicate that San Diego County will be the leading coastal county in population increase from 2003 to 2008. Along with Orange, San Bernardino, and Riverside counties, it will account for 12% of the nation's expected coastal population growth (Crossett et al. 2004). Projected growth will also be high in the San Francisco Bay region and the Sacramento-Yolo county area.

These areas seem to qualify as "hotspots of vulnerability," that is, areas with both restricted-range species and high projected rates of human population growth and development (Abbitt et al. 2000). On a broader scale, such hot spots correspond to many of the areas in the United States with large numbers of endangered species.

Likewise, urbanization continues to reduce agricultural lands in the Central Valley at a rate among the highest in North America (American Farmland Trust 1995, Sorensen et al. 1997). Also, housing densities are expected to increase greatly on private forests in some regions of California in the next three decades (Stein et al. 2005).

Changing Threats

Vigilance is needed as threats facing birds change over time. In the 19th and early 20th centuries,

birds were heavily exploited for their feathers, meat, and eggs, but demand waned with legal regulations and changing attitudes (Wilcove et al. 2000). Similarly, in the past few decades reproductive impairment of birds has been greatly reduced by banning, regulating, and managing the use of toxic compounds (e.g., Boellstorff et al. 1985, Snyder-Conn et al. 1999). Today, birds in California face a variety of threats, but foremost among them is habitat loss and degradation, including fragmentation (Table 6). Habitat loss is also the single greatest threat to birds throughout the United States (Wilcove et al. 1998) and worldwide (Collar et al. 1994). Habitat loss also can explain much of the patterns of variation in numbers of at-risk species across entire countries and may be the leading factor inhibiting their recovery (Kerr and Deguise 2004). Thus, strategies to conserve at-risk birds in California must place a high priority on protection, restoration, and enhancement of their habitats.

Given the pervasiveness of habitat loss and degradation, conservationists should be constantly attuned to potential new threats to at-risk birds that might exacerbate current problems. Examples are transmission of long-standing diseases by novel mechanisms, as in the case of type C botulism killing thousands of pelicans and other fish-eating birds at the Salton Sea in the 1990s (Rocke et al. 2004), or the rapid spread of entirely new diseases such as West Nile virus, which has spanned North America since 1999, killing thousands of birds of a variety of species (Marra et al. 2004). Although future impacts are uncertain, this virus has been linked to local declines of birds, and it appears that corvids and some flocking waterbirds may be particularly susceptible. Biologists have already shown that West Nile virus has reduced late summer survival of Greater Sage-Grouse (Naugle et al. 2004). In addition to these grouse, California's endemic corvids (the Yellow-billed Magpie and Island Scrub-Jay) should be closely monitored for signs of large-scale mortality or reduced fitness from this virus.

Ways to Prioritize

The large number of prioritization schemes that are applicable to California at the state, national, or continental scale (Appendix 2) can confuse those attempting to set conservation priorities. Confusion may arise because various schemes are designed for different purposes, or when lists mix short- and long-term conservation goals without so stating. For the latter reason we developed two lists for California: the primary Bird Species of Special Concern list (Table 1) and a complementary but secondary Bird Responsibility List (Table 8). The former has regulatory implications and will serve best as a tool for short- to medium-term planning; the latter will serve best for medium- to long-term planning.

The species of concern list provides direction for conservation and research by identifying three levels of priority. Prioritization can be further refined by other factors. We recommend raising the priority of taxa that occur on both the special concern and responsibility lists (see Tables 1 and 8), as not only are these in immediate need of protection but also their continental or global conservation can be ensured only by actions taken mostly in California. Taxa warranting heightened consideration are ones on either of the two California lists that are also listed as "vulnerable" at the global scale by the IUCN (2006; see Appendix 2). The only such species on the current BSSC list is the Mountain Plover, though the Xantus's Murrelet, originally a nominee but since listed as state threatened, also meets the IUCN criterion. Priority might also be raised for funding for restoration, research, or monitoring if multiple species of special concern might benefit. Such a case might involve projects along the Colorado River that could simultaneously benefit special concern taxa such as the Vermilion Flycatcher, Crissal Thrasher, Lucy's Warbler, Sonora Yellow Warbler, and Summer Tanager, as well as threatened and endangered taxa such as the Western Yellow-billed Cuckoo, Elf Owl, Gila Woodpecker, Gilded Flicker, Southwestern Willow Flycatcher, and Arizona Bell's Vireo. Projects of this sort might have a very high rate of return relative to expenditure. Because today so much conservation planning is habitat based, efforts to prioritize for the protection of species of special concern should be coordinated with other California plans for habitats such as grasslands, oak woodlands, and riparian forests and woodlands (CalPIF 2000, 2002; RHJV 2004). Priorities sometimes may be superceded by opportunities, however, such that low priority species may fortuitously benefit from actions that occur in an area with no high priority species.

Evaluation of patterns of distribution of special concern taxa with respect to habitats and geographic areas of the state (Tables 4 and 5) provides some additional insight for prioritization at the local, regional, or statewide level. Recognition of distribution patterns by habitat will alert those with management responsibility for various habi-

tats of the special concern taxa most in need of conservation when prioritizing restoration or land acquisition. Similarly, knowledge of the distribution of these taxa by geographic areas will help local and regional planners address both human needs and those of birds most in need of protection. This may be especially important in areas such as coastal southern California, which holds a high number of species of concern, has lost vast tracts of native habitat, and faces ongoing development. These pressures are expected to intensify on the basis of projected rates of future population increase.

Research and Monitoring

The need for research and monitoring to enable protection and recovery of birds of special concern has been recognized since the inception of the list (Remsen 1978). Our evaluation of the effectiveness of current monitoring programs for these taxa indicates that progress in this realm has been modest in the past two decades. Effective monitoring programs are also needed for all "Taxa to Watch" and all nominees to the current special concern list. Similarly, the many research needs listed in the species accounts highlight the importance of gathering more information to foster adaptive management for these birds by taking corrective action as new insights are gained (Walters 1986). We recommend that, when possible, monitoring programs be designed to encompass multiple species (both at-risk taxa and others) to economize effort and maximize benefit. Single-species monitoring will still be needed, however, as simulations of multispecies monitoring of vertebrate taxa in the Sierra Nevada indicate that detections would be inadequate for rare and endemic species and species of concern (Manley et al. 2004). Thus, monitoring programs for species of concern in California should overcome the difficulties of gathering suitable data on the many such taxa that have small populations or are very locally distributed.

Whenever possible, monitoring efforts for the state's special concern taxa should integrate and coordinate with regional or continental monitoring programs in existence (e.g., Pacific Flyway Council, http://pacificflyway.gov/Monitoring.asp, for waterfowl) or in development (e.g., Waterbird Monitoring Partnership, www.pwrc.usgs.gov/cwb/). Likewise, design and refinement of monitoring programs or research needs for special concern taxa in California should build on the coordinated efforts of continental assessments (e.g., Partners in Flight Research and Monitoring Needs Database, www.partnersinflight.org/pifneeds/).

Using the List to Foster Conservation

Stewardship Responsibility for a Rich Bird Fauna

California supports exceptional biodiversity because of its large size, diverse habitats and environmental heterogeneity, and relative isolation from the rest of the continent (Stein et al. 2000, Stein 2002). In terms of its flora and fauna, California leads the nation in overall species richness, number of state endemics, and rare species.

The state's avifauna is extraordinary at both national and global scales and thus deserves strong protection and conservation efforts on its behalf. As of 30 December 2006, the CBRC (2007) recognized 632 species of birds as having been documented for the state, including 283 regularly nesting native species. In terms of number of regularly occurring species of birds, California ranks among the top four states in the nation (Stein et al. 2000, Stein 2002); for number of subspecies of birds, it probably ranks at the very top (P. Unitt pers. comm.). On a global scale, it is the only mainland region of the United States recognized as an "Endemic Bird Area" by BirdLife International, because of its endemic and near-endemic bird fauna (Stattersfield et al. 1998). Along with the possession of such a rich and diverse bird fauna comes the responsibility for its conservation. The species of special concern list is one of several tools that can be used to help meet stewardship responsibility for the state's incredible bird life, and the habitat it depends on, and to foster conservation of its at-risk birds.

Legal and Regulatory Mandates

Although most birds in California are given protection by the federal Migratory Bird Treaty Act (MBTA; 16 U.S.C. 703–712) and its state counterpart, the Extension and State Codification of the MBTA (Fish and Game Code § 3513), few state or federal statutes have specific provisions requiring evaluation of the effects of detrimental actions on these species, and examples of enforcement of known destruction are exceptionally rare. Foremost among the statutes requiring strict evaluation of potential impacts are the federal (16 U.S.C. 1531–1543) and state (Fish and Game Code § 2050–2116) endangered species acts, which provide the highest level of protection to birds listed as threatened or endangered.

Other at-risk birds, such as species of special concern, may still obtain protection under other statutes. The California Environmental Quality Act (CEQA; California Public Resources Code § 21000–21177) requires state agencies, local governments, and special districts to evaluate and disclose impacts from "projects" in the state. Section 15380 of the CEQA Guidelines indicates that species of special concern must be treated as endangered, threatened, or rare if they meet the definitions. Of particular relevance to species of concern is section 15063 of the guidelines, which addresses mandatory findings of significance and the standards under which a lead agency determines if impacts to biological resources should be considered significant, thereby triggering preparation of an Environmental Impact Report under CEQA. Project-level impacts to listed (rare, threatened, or endangered) species are generally considered significant and thus require lead agencies to prepare an Environmental Impact Report to fully analyze and evaluate the impacts. In assigning "impact significance" to populations of nonlisted wildlife species, analysts usually consider factors such as population-level effects, proportion of the taxon's range affected by a project, and impacts to habitat features. Similarly, the National Environmental Policy Act (NEPA; 42 U.S.C. 4321–4347) requires federal agencies to consult with the U.S. Fish and Wildlife Service to avoid or mitigate impacts to sensitive species if a federal action would result in a "significant impact." The BSSC document contains sufficient detail to aid those determining and defending the assignment of impact significance under both CEQA and NEPA.

The Natural Community Conservation Planning (NCCP) Act (Fish and Game Code § 2800–2840) establishes a statewide program for the development of broad-based regional conservation plans. Its goals are to "provide for effective protection and conservation of the State's wildlife heritage while continuing to allow appropriate development and growth" (§ 2801). Administered by CDFG, the NCCP program promotes voluntary collaborative planning between CDFG and other state agencies, federal and local governments, property owners, developers, and environmental groups. NCCP plans seek to conserve ecosystems and their associated species. Some of these species are currently listed as threatened or endangered, but others are considered sensitive species with the potential to be listed in the future. Those deemed adequately conserved by an NCCP plan are called "covered species."

The U.S. Congress amended section 10 of the federal Endangered Species Act to authorize "incidental take" through the development and implementation of Habitat Conservation Plans (HCPs), which remain in effect through the life of the project (Nelson 1999). The HCP integrates the applicant's proposed project or activity with species' needs and describes, among other things, the anticipated effect of a proposed taking on affected species and how that take will be minimized and mitigated. HCPs also include conservation measures for other at-risk species, including candidate species, proposed species, and others of concern at the time an HCP is developed or a permit application is submitted. This process benefits the permittee by ensuring that the terms of an HCP will not change over time with subsequent species listings, while also providing early protection for many species, ideally preventing declines and, perhaps, the need to list them.

The BSSC document will serve an important function in providing planners with a list of important bird taxa to consider and prioritize for conservation when initiating and implementing NCCPs and HCPs.

Conservation Approaches: Single Species to Landscapes

Ongoing habitat loss and degradation from a rapidly expanding human population, coupled with limited resources to cope with attendant impacts, require a multitude of conservation actions, some regulatory, others voluntary. Conservation biologists have proposed a number of ways to design reserve networks and select areas that have the highest need for protection. These include selection of "hotspots"—geographic areas with high species numbers (richness), endemism, or rare or threatened species—which may vary over spatial and temporal scales (e.g., Williams et al. 1996, Flather et al. 1998, Reid 1998, Rutledge et al. 2001). Selection may also be based on surrogate species, including those with large range sizes whose protection may also mean protection of many other species (umbrella species) or ones that denote areas of high species richness (indicator species; Lambeck 1997, Caro 2000, Rubinoff 2001). Chase et al. (2000), however, suggested that efforts to conserve birds of coastal sage scrub in southern California should not focus exclusively on rare species or on areas with the highest species richness but on a diverse suite of species representative of the range of variation in communities found in sage scrub habitats. Furthermore,

the inclusion of species that are relatively common or easily monitored can produce the necessary sample size to measure population response to habitat change or loss (Chase and Geupel 2005). This "focal-species" approach has been applied to planning efforts for California's major habitat types and is the foundation of California Partners in Flight, a statewide initiative to conserve birds and habitat.

While too great a focus on conservation of one or a few extremely rare species may be undesirable, a proactive approach that considers all native species equally may shift scarce resources away from species that could benefit the most from them (Cassidy et al. 2001). Multispecies planning efforts can also benefit from knowledge gained from single-species conservation plans (e.g., Shuford 1999), as areas managed for multiple species may not necessarily provide extensive habitat for species with restricted needs (e.g., Shuford et al. 2001).

Others have emphasized biodiversity conservation at a landscape, ecosystem, or habitat level that supports natural processes and their natural ranges of variability (e.g., Poiani et al. 2000). Efforts to identify optimal reserve networks over large landscapes are, of course, laudable, but these work best when the entire network can be implemented immediately. More simple decision rules, such as protecting the available site with the highest irreplaceability or species richness, may be more effective when implementation occurs over many years (Meir et al. 2004).

In summary, a high priority should be placed on protecting natural processes and species, subspecies, and distinct populations that are nearing endangerment because of declining populations or vulnerability to threats. The identification of such taxa by California's BSSC list provides a starting point from which to work regardless of the method of protection selected. Success will be enhanced if efforts are intensified before populations decline further and if they emphasize voluntary rather than regulatory measures.

Synergy via Partnerships and Approaches

Protection, restoration, and enhancement of habitats for at-risk species will of necessity take a multifaceted approach. The Department of Fish and Game already considers species of special concern during the processes of environmental review (e.g., CEQA), conservation planning, land acquisition, and preparation of management plans for department lands, and during inventories, surveys, and monitoring conducted by the department or its cooperators. Habitat Conservation Plans and Natural Community Conservation Plans are innovative approaches (O'Connell and Johnson 1997, Harding et al. 2001) and, as noted above, seem well suited to addressing the needs of species of special concern. To be effective, these efforts should be enhanced by the actions of other stakeholders, including other state, federal, and local agencies, nongovernmental organizations, and private landowners. Although regulatory actions afford some protection, other methods may prove more effective. Such methods include public and private land acquisition, conservation easements, tax incentives, and cost-share programs for habitat enhancement (Bean 2000). Cooperative and proactive efforts among agencies and other groups and between managers and scientists tend to be the most effective in sensitive species protection (Squires et al. 1998).

Knowledge of the distribution of at-risk taxa can be useful in identifying Important Bird Areas (Grimmett and Jones 1989; for California, Cooper 2004), thereby highlighting their need for protection. While creation of new reserves is highly desirable, an emphasis on terrestrial reserves may come at the expense of marine reserves (Lindholm and Barr 2001). There currently is a strong movement to establish fully protected marine reserves (Roberts and Hawkins 2000, National Research Council 2001), which are needed in California. There also is recognition that protection of many migratory species will require cooperation across international borders (Commission for Environmental Cooperation 2000).

State, Regional, and Continental Conservation Planning

Broad-scale habitat loss and declines in bird populations have stimulated the development of various national or continental, multipartner conservation initiatives in North America over the past two decades. The first of these focusing on wetland birds was the North American Waterfowl Management Plan in 1986 (updated three times; NAWMP Plan Committee 2004), implemented through regional joint ventures. Subsequent plans include the U.S. Shorebird Conservation Plan (Brown et al. 2001) and the North American Waterbird Conservation Plan (Kushlan et al. 2002). These plans implement conservation actions through their respective regional plans (e.g., Hickey et al. 2003, Ivey and Herziger 2006) and working groups (typically

organized around Bird Conservation Regions), often in collaboration with joint ventures of the waterfowl plan.

Similar conservation initiatives for terrestrial landbirds have been developed since 1990 under the umbrella of Partners in Flight (Rich et al. 2004). Landbird conservation is being implemented by regional and state working groups, habitat-based conservation plans (e.g., CalPIF 2000, 2002), specific habitat joint ventures (e.g., California Riparian Habitat Joint Venture, RHJV 2004), and the joint ventures of the waterfowl plan. The latter have begun to consider conservation for all birds.

With an accelerated pace of conservation planning, there is an increasing need for integration of various plans at the state, regional, national, and international levels to catalyze efficient use of partnerships and resources. In 1999, the North American Bird Conservation Initiative (NABCI) formed to achieve integrated bird conservation to benefit all birds in all habitats. Its coalition of partners aim to "ensure the long-term health of North America's native bird populations by increasing the effectiveness of their bird conservation initiatives and programs, enhancing coordination among their initiatives and programs, and fostering greater cooperation among the continent's three national governments and their people" (www.nabci-us.org/nabci.html).

In California, the Department of Fish and Game recently met requirements of the federal State Wildlife Grants program by developing a state Comprehensive Wildlife Conservation Strategy under the California Wildlife Diversity Project (CDFG 2007). This effort reviewed wildlife species (invertebrates, vertebrates) of concern in each bioregion of the state to identify conservation challenges and develop a strategy or framework that will highlight stewardship activities necessary to halt species' declines and to maintain species diversity. The project acknowledges the importance of the approach used in the BSSC document in developing a rigorous and defensible assessment of factors responsible for the decline and vulnerability of many California bird taxa and considers many of the same recommendations in constructing the framework (K. Hunting pers. comm.).

The development of the ranking system of California Bird Species of Special Concern has benefited from extensive review of comparable ranking systems of the aforementioned conservation initiatives (e.g., Carter et al. 2000, Panjabi 2001). Conversely, a draft version of the BSSC system was consulted in development of U.S. Fish and Wildlife Service's national ranking of Birds of Conservation Concern 2002 (USFWS 2002, T. Zimmerman pers. comm.) and for the ranking of conservation concern for waterbirds in the Intermountain West (Ivey and Herziger 2006). The prior draft BSSC list has already been used as one element in the ranking of priority for on-the-ground restoration projects on private lands in California, for example, the California Landowner Incentive Program (D. Smith pers. comm.). Also, California Partners In Flight has been using the draft BSSC list as its primary reference for identifying species of concern in California and will use the published document for information on their current status and conservation issues (G. Geupel pers. comm.).

BSSC and the other conservation initiatives should prove to be synergistic over the long term. Other plans likely will benefit both from BSSC's detailed assessments of status and recommendations for research, management, and monitoring in its species accounts and from the overview analyses of the habitats and regions of the state where conservation of at-risk taxa is most needed. Likewise, subsequent updates of the BSSC list, and the taxa identified, will benefit enormously from the ongoing information gathering and implementation of the science-based conservation initiatives.

Recommendations

To promote advances in conservation of birds of special concern in California, we recommend the following:

- Establish a permanent Bird Species of Special Concern Technical Advisory Committee to meet annually to review the status of California's at-risk birds. The committee would vote on recommendations to CDFG on adding or removing taxa from the special concern list on the basis of documented information provided in support of requests for changes to specific scoring criteria.
- Update and thoroughly revise the special concern report every five years, or more frequently if circumstances warrant it. When possible, refine the ranking criteria and scheme to improve their ability to identify species of concern and place them within priority categories for conservation; also seek ways to reduce or better account for uncertainty of biological data.
- In future revisions of the California Bird Species of Special Concern list, highlight

increasing populations and any actions responsible for their recovery. This strategy can bolster optimism, an important component of effective conservation (Beever 2000), thereby strengthening public motivation and advancing the confidence of conservationists by quantifying and stressing successes and by showing promising possibilities for action (Gigon et al. 2000).

- Maintain an online database to track new information on special concern taxa and to document criteria scores and any changes made to them. The database's website should allow for online entry of new data on birds of special concern, following quality control protocols established by CDFG. Also, refine the database with scores for all nominee taxa to better document the sources of information forming the basis for scores so that scores can more readily be updated and new taxa added to the special concern list as warranted.
- Prepare a report to recommend specific, cost-effective protocols that can be used to monitor trends of all special concern taxa. Methods should strive to monitor multiple species simultaneously, produce statistically valid results with error estimates, and incorporate skilled volunteers and citizen scientists whenever possible to both lower costs and broaden the constituency for protection of at-risk birds. Monitoring goals should be well articulated to answer specific questions relevant to management (Noss 1990).
- Identify a volunteer coordinator to obtain and maintain volunteer support for monitoring programs of special concern birds.
- Prepare a report recommending research priorities for the next decade that will provide needed information to enable better management to protect and aid recovery of populations of at-risk birds (see Mace et al. 2001, Soulé and Orians 2001). Building on recommendations in the species accounts in this document, the report should prioritize research needs on not only the ecology of at-risk birds but also baseline distributional surveys needed to develop plans for habitat protection and taxonomic studies needed to broaden our understanding of what needs to be protected. Prioritization of research needs should stem from a ranking of the uncertainty of knowledge on which the various criteria scores for each taxon were based and on the likelihood of answering important questions relevant to management and recovery of declining or threatened populations. Research needs should be prioritized both for each taxon and across all taxa. Recommendations should include creative and novel approaches to fund such research.
- Prepare a report that predicts the impacts of climate change on both current BSSC taxa and those California bird taxa considered most sensitive to its effects but not yet at risk because current impacts are low (i.e., species that have a latent risk of extinction; Cardillo et al. 2006). Such an analysis should serve as an early warning system to guide managers in adopting a longer-term approach to conservation. Indeed, some climate scenarios, if realized, are expected to produce greater extinction rates than habitat loss, currently the top threat to biodiversity (see Wormworth and Mallon 2006).
- Prepare a training module for CDFG staff, other state, federal, and local agencies, private organizations, and private citizens to review the purpose and application of species of special concern lists and how they fit into impact analysis and land use planning.
- Develop an outreach program to inform biologists, land managers, and decision makers of the need to protect at-risk birds and of the best methods to do so. Materials should emphasize that money spent up front to protect and maintain self-sustaining ecosystems will be far less than that needed later to fund costly recovery and restoration programs.
- Identify a department liaison to coordinate with other multispecies conservation efforts (e.g., Partners in Flight, U.S. Shorebird Conservation Plan) to ensure these plans adequately address the needs of special concern taxa and, conversely, to gather information that can be used for multispecies planning for these at-risk birds. Efforts should strive as much as possible to achieve synergy and consistency between bird species of special concern protection and development and implementation of habitat- or taxonomic-based conservation plans.

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Andy Birch

Appendices

Appendix 1: Annotated List of Taxa to Watch

This list includes taxa that are not on the current special concern list that (1) formerly were on the prioritized 1978 (Remsen 1978) or unprioritized 1992 (CDFG 1992) special concern lists and are not currently listed as state threatened and endangered, (2) have been removed (delisted) from either the state or federal threatened and endangered lists (and remain on neither), or (3) are currently designated as "fully protected" in California (www.dfg.ca.gov/hcpb/species/species.shtml). Brief accounts are provided below for all such taxa; their criteria scores, which indicate lack of biological justification for inclusion on the current BSSC list, are available from CDFG.

Aleutian Cackling Goose

A very large proportion of this subspecies of the Cackling (formerly Canada) Goose stages during migration and winters in California. It was listed as federally endangered in 1967, downlisted to federally threatened in 1990, and delisted in 2001, when the population was considered recovered.

Trumpeter Swan

The Trumpeter Swan is currently considered a "fully protected" species in California. This species' historic status in California is unclear because of problems in identifying it. Grinnell and Miller (1944) reported that it was "believed to have been of regular occurrence, formerly, though in smaller numbers than Whistling [Tundra] Swan . . . [and had been] reported but once since 1900." This swan currently is so rare in California that all known records are evaluated by the California Bird Records Committee (CBRC). Beyond identification problems, the CBRC has struggled with records of this species because of the highly managed nature of many populations in the conterminous United States (especially eastern Washington and eastern Oregon). Some birds in California in winter may originate from populations introduced to, but not well established in, areas outside the species' historic breeding range and hence may not represent normal movements of birds from native or well-established introduced populations (McCaskie and San Miguel 1999).

Ruffed Grouse

Included on both prior special concern lists (Remsen 1978, 3rd priority; CDFG 1992). Although this species is considered a "rare" resident in northwestern California, there appears to be no evidence of population declines in this region (Harris 2005).

Double-crested Cormorant

Included on both prior special concern lists (Remsen 1978, 2nd priority; CDFG 1992). Coastal breeding populations have increased since at least the early 1980s (Carter et al. 1992); apparent increases in interior breeding populations are difficult to interpret because of limited historical data (W. D. Shuford unpubl. data). BBS data for the species in California showed a marginally significant positive trend for the period 1968–2004 (Sauer et al. 2005).

White-faced Ibis

Included on both prior special concern lists (Remsen 1978, highest priority; CDFG 1992). Both breeding and wintering populations have increased greatly in California since the 1980s (Shuford et al. 1996, Earnst et al. 1998).

Osprey

Included on both prior special concern lists (Remsen 1978, 2nd priority; CDFG 1992). Breeding populations have increased significantly in California in recent decades (Gould and Jurek 1988, Sauer et al. 2005).

White-tailed Kite

This kite is currently considered a "fully protected" species in California. Despite the difficulty of tracking the trends of a species that fluctuates greatly from year to year, numbers of kites on BBS routes in California have been relatively stable over the period 1968–2004 (Sauer et al. 2005).

Sharp-shinned Hawk

Included on both prior special concern lists (Remsen 1978, 3rd priority; CDFG 1992). There

does not appear to be any evidence of persistent population decline in this species in California. BBS data (1968–2004) for California are inadequate for trend assessment (Sauer et al. 2005).

Cooper's Hawk

Included on both prior special concern lists (Remsen 1978, 3rd priority; CDFG 1992). Breeding populations have increased in California and expanded into urban areas (California county breeding bird atlas data). BBS data (1968–2004) for the species in California are inadequate for trend assessment (Sauer et al. 2005).

Harris's Hawk

Included on both prior special concern lists (Remsen 1978, highest priority; CDFG 1992). Occurrence of this hawk is cyclic in nature in extreme southern California, where it is on the fringe of its natural range (Patten and Erickson 2000). The most recent incursion into the state, apparently from Baja California, was relatively short lived. Beginning in 1994, nearly 50 individuals ranged into California, with most birds in eastern San Diego County. Numbers reached a peak rapidly, and despite nesting from 2000 to 2002—representing the first known successful nesting of wild Harris's Hawks in California for over 40 years—by 2003 the birds had disappeared (Unitt 2004). Incursions into California appear to be in response to conditions outside the state.

Ferruginous Hawk

Included on the previous special concern list (CDFG 1992). There appears to be no documented evidence of substantial declines in numbers of this hawk wintering in California. Expansion of urban development and of vineyards into former grasslands has reduced some foraging areas for the species.

Golden Eagle

Included on both prior special concern lists (Remsen 1978, 3rd priority; CDFG 1992); currently considered a "fully protected" species in California. Numbers of Golden Eagles on BBS routes in California have been relatively stable over the period 1968–2004 (Sauer et al. 2005).

Merlin

Included on both prior special concern lists (Remsen 1978, highest priority; CDFG 1992). Merlins have increased as migrants and wintering birds in California in recent decades (A. Fish/ Golden Gate Raptor Observatory unpubl. data).

Prairie Falcon

Included on both prior special concern lists (Remsen 1978, 3rd priority; CDFG 1992). Prior indications of declines of this species in California (Garrett and Mitchell 1973) have been balanced by more recent assessments of population stability (Boyce et al. 1986). Christmas Bird Count data for California, for this resident species, showed a statistically significant positive trend for the period 1959–1988 (Sauer et al. 1996). BBS data for this species in California are inadequate for trend assessment (Sauer et al. 2005).

Long-billed Curlew

Included on the previous special concern list (CDFG 1992). A small population of curlews breeds in the Great Basin Desert, Modoc Plateau, and Klamath Basin of northeastern California (Grinnell and Miller 1944, D. Shuford pers. obs.). BBS data (1968–2004) for California are inadequate for trend assessment (Sauer et al. 2005), and even anecdotal information on the status of curlews is limited for this remote region of the state.

Laughing Gull

Included on both prior special concern lists (Remsen 1978, highest priority; CDFG 1992). A few pairs of Laughing Gulls have bred sporadically at the Salton Sea from at least 1928 until the late 1950s, and one to two pairs since 1994 (Molina 2000). Breeding numbers at the Salton Sea are likely influenced by the dynamics of breeding populations in Mexico.

California Gull

Included on both prior special concern lists (Remsen 1978, 3rd priority; CDFG 1992). The main threat to the state's breeding population was eliminated by a state water board order in 1994, which will maintain lake levels at Mono Lake that will protect the state's largest colony from ground predators (Shuford and Ryan 2000). An increase in the statewide breeding population is being fueled mainly by exponential growth at the lone coastal breeding area in San Francisco Bay (Shuford and Ryan 2000, Strong et al. 2004).

Elegant Tern

Included on both prior special concern lists (Remsen 1978, 3rd priority; CDFG 1992). Elegant Terns first nested in California in the salt works at San Diego Bay in 1959 (Gallup and Bailey 1960). From the initial 31 pairs, the state's breeding population has increased exponentially and expanded to include additional colonies at Bolsa Chica, Orange County, in 1987 and the Los Angeles Harbor in 1998. While numbers have increased, the distinction of being the largest colony has traded back and forth among the three sites. The total number of breeding pairs exceeded 13,000 in 2003 and 11,000 in 2004, with >10,000 at San Diego Bay and Los Angeles Harbor in those years, respectively (B. Collins/USFWS, C. Collins, K. Keane unpubl. data). Although breeding sites are few, all are on human-created habitats in a region where suitable natural nesting habitat appears to have been very limited or nonexistent historically.

Rhinoceros Auklet

Included on both prior special concern lists (Remsen 1978, 3rd priority; CDFG 1992). The breeding population of the Rhinoceros Auklet has increased in number and expanded its range in California since the early 1970s, particularly since 1980 (Carter et al. 1992, McChesney et al. 1995). Despite suggestions of possible recent declines, threats to the species overall seem to be moderate and no greater than for most other seabirds in the state.

Brown-crested Flycatcher

Included on both prior special concern lists (Remsen 1978, 3rd priority; CDFG 1992). Grinnell and Miller (1944) considered this species a "marginal pioneer" on the basis of two specimens collected in the lower Colorado River valley near Bard, Imperial County, in 1921. The species apparently increased dramatically along the Colorado River after the 1940s, in spite of massive habitat loss, and spread west to Morongo Valley, San Bernardino County, and South Fork Kern River valley, Kern County (Banks and McCaskie 1964, Garrett and Dunn 1981, Rosenberg et al. 1991, Johnson 1994). Despite the prior population increase and recent range expansion, numbers along the Colorado River decreased from an estimated 800 individuals in 1976 to 435 by the mid-1980s (Rosenberg et al. 1991).

Eagle Mountain Western Scrub-Jay

Included on the previous special concern list (CDFG 1992). This subspecies, ascribed solely from Eagle Mountain, Riverside County (AOU 1957), is of questionable validity (P. Unitt pers. comm.). Regardless, there appears to be no evidence of a population decline within its limited described range.

California Horned Lark

Included on the previous special concern list (CDFG 1992). This subspecies of Horned Lark occurs on the state's central and southern coastal slope and in the San Joaquin Valley. Although BBS data showed a highly significant decline for this species as a whole in California from 1968 to 2004 (Sauer et al. 2005), there is only limited anecdotal evidence of recent declines in this subspecies, mainly from southern California (S. Myers pers. comm.).

Black-capped Chickadee

Included on both prior special concern lists (Remsen 1978, 3rd priority; CDFG 1992). Since at least the late 1980s, this species has expanded its range southward from its California stronghold in the Lake Earl-Smith River area, Del Norte County, to the Humboldt Bay area, Humboldt County (south to Ferndale; Harris 1996, Hunter et al. 2005). BBS data (1968–2004) for the species in California are inadequate for trend assessment (Sauer et al. 2005).

Black-tailed Gnatcatcher

Included on the initial special concern list (Remsen 1978, 2nd priority), particularly on the basis of declines of what was then considered a subspecies, the California Black-tailed Gnatcatcher (*Polioptila melanura californica*). This subspecies has since been classified as part of a separate species, the California Gnatcatcher (*Polioptila californica*), considered a species of concern (CDFG 1992); then in 1993 the Alta (coastal) California Gnatcatcher (*Polioptila californica californica*) was listed as federally endangered. Rosenberg et al. (1991) considered the Black-tailed Gnatcatcher a "common resident and breeder" that maintained "very stable" population sizes in the lower Colorado River valley from year to year. Numbers of Black-tailed Gnatcatchers on BBS routes in California showed a significant decline for the period 1968–1979 and nonsignificant declines from 1980 to 2004 and 1968 to 2004 (Sauer et al. 2005).

Le Conte's Thrasher

Included on both prior special concern lists (Remsen 1978, 3rd priority; CDFG 1992). Numbers of Le Conte's Thrashers on BBS routes in California showed a nonsignificant decline from 1968 to 2004 (Sauer et al. 2005). In addition to the relative stability of numbers, threats to the bulk of the population in the southern deserts appear to be low (but see the account for the San Joaquin population).

Virginia's Warbler

Included on both prior special concern lists (Remsen 1978, 3rd priority; CDFG 1992). This warbler breeds in arid mountain ranges mostly along the Nevada border and has expanded its range westward to the San Bernardino Mountains, San Bernardino County (Johnson and Garrett 1974), and to Glass Mountain, Mono County (Shuford and Metropulos 1996). Although the overall population in California appears to be small, there seems to be no evidence of population declines or major threats to its existence in the state.

Hepatic Tanager

Included on both prior special concern lists (Remsen 1978, 3rd priority; CDFG 1992). This species expanded its range into California in the late 1960s to early 1970s (Johnson and Garrett 1974, Johnson 1994). Garrett and Dunn (1981) considered this species a "rare" summer resident on arid mountain ranges in the Mojave Desert of San Bernardino County. Their estimate for population size in 1977 was two pairs on Clark Mountain, three pairs in the Kingston Mountains, and one pair in the New York Mountains; one to two pairs were in the northeastern San Bernardino Mountains sporadically from the late 1960s to 1980. As with several other species occurring in very small numbers in southeastern California, the size of this tanager's population in the state is likely affected by population dynamics in Arizona.

Southern California Rufous-crowned Sparrow

Included on the previous special concern list (CDFG 1992). Although BBS data are not available by subspecies, numbers of Rufous-crowned Sparrows overall (two mainland races) have been relatively stable on routes in California over the period 1968–2004 (Sauer et al. 2005). Although its spatial pattern of abundance in urban-fragmented habitat in southern California suggests it is sensitive to changes in habitat configuration or quality that occur with fragmentation, reproductive output did not differ between sparrows nesting in the interior of sage scrub patches and those breeding in habitat adjacent to urban edges (Morrison and Bolger 2002).

Bell's Sage Sparrow

Included on the previous special concern list (CDFG 1992). Concern has been expressed for populations of this sparrow in southern California (J. Lovio in litt.), but it seems to be holding its own in northern California and in the state as a whole (S. England in litt.).

Gray-headed Junco

Included on both prior special concern lists (Remsen 1978, 3rd priority; CDFG 1992). A rare breeder in the White and Inyo mountains, Inyo County; the Grapevine Mountains, Inyo County (or at least on Nevada side); and Clark Mountain, San Bernardino County (Grinnell and Miller 1944, Garrett and Dunn 1981, Johnson and Cicero 1986). This junco was unknown from the White-Inyos prior to 1954, when it was considered to be "fairly common"; recently it was reported to be a rare summer resident of the White-Inyos (Johnson and Cicero 1986). Fluctuations in junco numbers in mountains along the California border are likely affected by population dynamics of juncos in nearby mountains in Nevada.

Northern Cardinal

Included on both prior special concern lists (Remsen 1978, 3rd priority; CDFG 1992). Northern Cardinals became established along the lower Colorado River, San Bernardino and Imperial counties, in the mid-1940s (Garrett and Dunn 1981, Rosenberg et al. 1991). These authors, respectively, considered the species "very rare" on the California side of the river and "rare and local" along the lower river as a whole. The fluctuations of cardinal numbers along the California border are likely a result of dynamics of breeding populations in Arizona.

Appendix 2: Status Designations of Conservation Concern for California Birds from Various State, Regional, Continental, and Global Assessments[a]

Taxon	BSSC 2008[b]	BSSC 1992[c]	BSSC 1978[d]	T & E[e]	Fully Protected[f]	NatureServe[g]	USFWS 2002[h]	Audubon WatchList 2002	IUCN 2006[j]
Fulvous Whistling-Duck	1	x	1	–	–	S1	–	–	–
Tule Greater White-fronted Goose	3	–	–	–	–	–	–	–	–
Brant	2	–	–	–	–	–	–	Y	–
Aleutian Cackling Goose	–	–	–	–	–	S2	–	–	–
Trumpeter Swan (*Cygnus buccinator*)	–	–	–	–	–	–	–	Y	–
Canvasback (*Aythya valisineria*)	–	–	–	–	–	S2?	–	–	–
Redhead	2	–	–	–	–	–	–	–	–
Harlequin Duck	2	x	3	–	–	S2	–	–	–
Barrow's Goldeneye	EX	x	3	–	–	S1	–	–	–
Ruffed Grouse (*Bonasa umbellus*)	–	x	3	–	–	–	–	–	–
Greater Sage-Grouse	2	x	3	–	–	S3	–	Y	NT
Blue Grouse (*Dendragapus obscurus*) (now split as Dusky Grouse [*D. obscurus*] and Sooty Grouse [*D. fuliginosus*])	–	–	–	–	–	–	–	Y	–
Mount Pinos Sooty Grouse	2	–	–	–	–	S?	–	–	–
Sharp-tailed Grouse	EX	x	1	–	–	SX	–	–	–
Mountain Quail (*Oreortyx pictus*)	–	–	–	–	–	–	–	Y	–
Catalina California Quail	3	–	–	–	–	–	–	–	–
Common Loon	EX	x	1	–	–	S1	–	–	–
Laysan Albatross (*Phoebastria immutabilis*)	–	–	–	–	–	–	–	Y	VU
Black-footed Albatross (*Phoebastria nigripes*)	–	–	–	–	–	–	R, 5, 32	R	EN
Short-tailed Albatross	FNS	–	–	FE	–	–	–	R	VU
Cook's Petrel (*Pterodroma cookii*)	–	–	–	–	–	–	–	–	EN
Pink-footed Shearwater (*Puffinus creatopus*)	–	–	–	–	–	–	–	R	VU
Buller's Shearwater (*Puffinus bulleri*)	–	–	–	–	–	–	–	Y	VU
Sooty Shearwater (*Puffinus griseus*)	–	–	–	–	–	–	–	–	NT
Black-vented Shearwater (*Puffinus opisthomelas*)	–	–	–	–	–	–	–	R	NT
Fork-tailed Storm-Petrel	3	x	2	–	–	S1	–	–	–
Ashy Storm-Petrel	2	x	3	–	–	S2	R, 32	R	EN
Black Storm-Petrel	3	x	3	–	–	S1	–	Y	–
Least Storm-Petrel (*Oceanodroma microsoma*)	–	–	–	–	–	–	–	Y	–
American White Pelican	1	x	1	–	–	S1	–	–	–
California Brown Pelican (*Pelecanus occidentalis californicus*)	–	–	–	SE, FE	x	S1S2	–	–	–
Double-crested Cormorant (*Phalacrocorax auritus*)	–	x	2	–	–	S3	–	–	–
American Bittern (*Botaurus lentiginosus*)	–	–	–	–	–	S3	–	–	–

Least Bittern	2	x	3	–	–	S1	–	–	–
Black-crowned Night-Heron (*Nycticorax nycticorax*)	–	–	–	–	–	S3	–	–	–
White-faced Ibis (*Plegadis chihi*)	–	x	1	–	–	S1	–	–	–
Wood Stork	1	x	–	–	–	S2?	–	–	–
California Condor	–	–	–	SE, FE	x	S1	–	R	CR
Osprey (*Pandion haliaetus*)	–	x	2	–	–	S3	–	–	–
White-tailed Kite (*Elanus leucurus*)	–	–	–	–	x	S3	–	–	–
Bald Eagle (*Haliaeetus leucocephalus*)	–	–	–	SE	x	S2	–	–	–
Northern Harrier	3	x	2	–	–	S3	–	–	–
Sharp-shinned Hawk (*Accipiter striatus*)	–	x	3	–	–	S3	–	–	–
Cooper's Hawk (*Accipiter cooperii*)	–	x	3	–	–	S3	–	–	–
Northern Goshawk	2	x	3	–	–	S3	–	–	–
Harris's Hawk (*Parabuteo unicinctus*)	–	x	1	–	–	SH	–	Y	–
Swainson's Hawk (*Buteo swainsoni*)	–	–	1	ST	–	S2	R, 9, 32	Y	–
Ferruginous Hawk (*Buteo regalis*)	–	x	–	–	–	S3S4	9	Y	NT
Golden Eagle (*Aquila chrysaetos*)	–	x	3	–	x	S3	9	–	–
Merlin (*Falco columbarius*)	–	x	1	–	–	S3	–	–	–
American Peregrine Falcon (*Falco peregrinus anatum*)	–	–	–	SE	x	S2	R, 5, 9, 15, 32, 33	–	–
Prairie Falcon (*Falco mexicanus*)	–	x	3	–	–	S3	R, 9, 32	–	–
Yellow Rail	2	x	1	–	–	S1S2	R, 9	Y	–
Black Rail	–	–	–	–	–	–	–	R	NT
California Black Rail	–	–	–	ST	x	S1	R, 32, 33	–	–
California Clapper Rail	–	–	–	SE, FE	x	S1	–	–	–
Light-footed Clapper Rail	–	–	–	SE, FE	x	S1	–	–	–
Yuma Clapper Rail	–	–	–	ST, FE	x	S1	–	–	–
Sandhill Crane	–	–	3	–	–	–	–	–	–
Lesser Sandhill Crane	3	–	–	–	–	–	–	–	–
Greater Sandhill Crane (*Grus canadensis tabida*)	–	–	–	ST	x	S2	–	–	–
Snowy Plover	–	x	2	–	–	–	–	R	–
Western Snowy Plover (*Charadrius alexandrinus nivosus*) (coastal population)	FNS	–	–	FT	–	S2	–	–	–
Snowy Plover (interior population)	3	–	–	–	–	–	R, 9, 33	–	–
Mountain Plover	2	x	–	–	–	S2?	R, 32, 33	R	VU
Black Oystercatcher (*Haematopus bachmani*)	–	–	–	–	–	S2	R, 5, 32	Y	–
American Avocet (*Recurvirostra americana*)	–	–	–	–	–	–	9	–	–
Whimbrel (*Numenius phaeopus*)	–	–	–	–	–	–	R, 5, 32, 33	Y	–
Long-billed Curlew (*Numenius americanus*)	–	x	–	–	–	S2	R, 5, 9, 32, 33	R	NT
Marbled Godwit	–	–	–	–	–	–	R, 5, 9, 32, 33	Y	–
Black Turnstone (*Arenaria melanocephala*)	–	–	–	–	–	–	R, 5, 32	Y	–
Surfbird (*Aphriza virgata*)	–	–	–	–	–	–	5	Y	–

(*continued*)

Appendix 2 (*continued*)

Taxon	BSSC 2008[b]	BSSC 1992[c]	BSSC 1978[d]	T & E[e]	Fully Protected[f]	NatureServe[g]	USFWS 2002[h]	Audubon WatchList 2002	IUCN 2006[i]
Red Knot (*Calidris canutus*)	–	–	–	–	–	–	R, 5, 32, 33	Y	–
Rock Sandpiper (*Calidris ptilocnemis*)	–	–	–	–	–	–	5	Y	–
Short-billed Dowitcher (*Limnodromus griseus*)	–	–	–	–	–	–	R, 5, 32	Y	–
Wilson's Phalarope (*Phalaropus tricolor*)	–	–	–	–	–	–	9	Y	–
Laughing Gull (*Larus atricilla*)	–	x	1	–	–	SH	–	–	–
Heermann's Gull (*Larus heermanni*)	–	–	–	–	–	–	–	R	NT
California Gull (*Larus californicus*)	–	x	3	–	–	S2	–	–	–
Yellow-footed Gull (*Larus livens*)	–	–	–	–	–	–	–	Y	–
California Least Tern (*Sternula antillarum browni*)	–	–	–	SE, FE	x	S2S3	–	–	–
Gull-billed Tern	3	x	2	–	–	S1	R, 32, 33	–	–
Caspian Tern (*Hydroprogne caspia*)	–	–	–	–	–	–	5	–	–
Black Tern	2	x	–	–	–	S2	–	–	–
Arctic Tern (*Sterna paradisaea*)	–	–	–	–	–	–	5	–	–
Elegant Tern (*Thalasseus elegans*)	–	x	3	–	–	S1	R, 32	R	NT
Black Skimmer	3	x	3	–	–	S1S3	R, 32, 33	–	–
Marbled Murrelet (*Brachyramphus marmoratus*)	–	–	3	SE, FT	–	S1	–	R	EN
Xantus's Murrelet (*Synthliboramphus hypoleucus*)	–	x	–	ST	–	S3	R, 32	R	VU
Craveri's Murrelet (*Synthliboramphus craveri*)	–	–	–	–	–	–	–	R	VU
Cassin's Auklet	3	–	–	–	–	S?	32	–	–
Rhinoceros Auklet (*Cerorhinca monocerata*)	–	x	3	–	–	S3	–	–	–
Tufted Puffin	1	x	2	–	–	S2	–	–	–
Band-tailed Pigeon (*Patagioenas fasciata*)	–	–	–	–	–	–	–	Y	–
Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*)	–	–	–	SE	–	S1	R, 5, 9, 32, 33	–	–
Flammulated Owl (*Otus flammeolus*)	–	–	–	–	–	S?	R, 5, 9, 15, 32	Y	–
Elf Owl (*Micrathene whitneyi*)	–	–	–	SE	–	S1	33	Y	–
Burrowing Owl	2	x	2	–	–	S2	R, 9, 32, 33	–	–
Spotted Owl	–	–	2	–	–	S3	–	R	NT
Northern Spotted Owl	FNS	–	–	FT	–	S2S3	–	–	–
California Spotted Owl	2	x	–	–	–	S3	15, 32	–	–
Great Gray Owl (*Strix nebulosa*)	–	–	–	SE	–	S1	–	–	–
Long-eared Owl	3	x	2	–	–	S3	–	–	–
Short-eared Owl	3	x	2	–	–	S3	–	Y	–
Black Swift	3	x	3	–	–	S2	R, 5, 15, 32	Y	–
Vaux's Swift	2	x	–	–	–	S3	–	–	–
White-throated Swift (*Aeronautes saxatalis*)	–	–	–	–	–	–	–	Y	–
Costa's Hummingbird (*Calypte costae*)	–	–	–	–	–	S3?	–	Y	–

Calliope Hummingbird (*Stellula calliope*)	–	–	–	–	–	–	–	Y	–
Rufous Hummingbird (*Selasphorus rufus*)	–	–	–	–	–	S1S2	5, 15	Y	–
Allen's Hummingbird (*Sealsphorus sasin*)	–	–	–	–	–	S?	–	Y	–
Lewis's Woodpecker (*Melanerpes lewis*)	–	–	–	–	–	S?	R, 5, 9, 15, 32	Y	–
Gila Woodpecker (*Melanerpes uropygialis*)	–	–	2	SE	–	S1S2	33	–	–
Williamson's Sapsucker (*Sphyrapicus thyroideus*)	–	–	–	–	–	–	R, 9, 15	–	–
Red-naped Sapsucker (*Sphyrapicus nuchalis*)	–	–	–	–	–	–	R	–	–
Red-breasted Sapsucker (*Sphyrapicus ruber*)	–	–	–	–	–	S?	–	–	–
Nuttall's Woodpecker (*Picoides nuttallii*)	–	–	–	–	–	S?	–	R	–
White-headed Woodpecker	–	–	–	–	–	S?	R, 5, 9, 15, 32	Y	–
Gilded Flicker (*Colaptes chrysoides*)	–	–	1	SE	–	S1	33	Y	–
Olive-sided Flycatcher	2	–	–	–	–	–	R, 5, 15	Y	NT
Willow Flycatcher (*Empidonax traillii*)	–	–	1	SE	–	S1S2	–	Y	–
Southwestern Willow Flycatcher (*E. t. extimus*)	–	–	–	FE	–	S1	–	–	–
Little Willow Flycatcher (*E. t. brewsteri*)	–	–	–	–	–	S1S2	–	–	–
Vermilion Flycatcher	3	x	1	–	–	S2S3	–	–	–
Brown-crested Flycatcher (*Myiarchus tyrannulus*)	–	x	3	–	–	S2S3	–	–	–
Loggerhead Shrike	2	x	–	–	–	–	R, 9, 32, 33	–	–
Island Loggerhead Shrike	1	–	–	–	–	S1?	32	–	–
San Clemente Loggerhead Shrike	FNS	–	–	FE	–	S1	–	–	–
Bell's Vireo (*Vireo bellii*)	–	–	–	–	–	–	–	R	NT
Least Bell's Vireo (*Vireo bellii pusillus*)	–	–	–	SE, FE	–	S2	–	–	–
Arizona Bell's Vireo (*Vireo bellii arizonae*)	–	–	1	SE	–	S1	33	–	–
Gray Vireo	2	x	2	–	–	S2	R, 33	Y	–
Catalina Hutton's Vireo	2	–	–	–	–	–	–	–	–
Island Scrub-Jay	–	–	–	–	–	S1	32	R	NT
Eagle Mountain Western Scrub-Jay	–	x	–	–	–	S1S2	–	–	–
Pinyon Jay (*Gymnorhinus cyanocephalus*)	–	–	–	–	–	–	–	Y	VU
Yellow-billed Magpie	–	–	–	–	–	S3?	–	Y	–
California Horned Lark	–	x	–	–	–	S3	–	–	–
Purple Martin	2	x	2	–	–	S3	–	–	–
Bank Swallow (*Riparia riparia*)	–	–	2	ST	–	S2S3	–	–	–
Black-capped Chickadee (*Poecile atricapillus*)	–	x	3	–	–	S3	–	–	–
Oak Titmouse	–	–	–	–	–	S3?	–	Y	–
Cactus Wren	–	–	–	–	–	–	32	–	–
San Diego Cactus Wren	1	x	–	–	–	S3	32	–	–
San Clemente Bewick's Wren	EX	–	–	–	–	–	–	–	–
Clark's Marsh Wren	2	–	–	–	–	–	–	–	–
California Gnatcatcher	–	x	–	–	–	–	–	R	–
Alta California Gnatcatcher	FNS	–	–	FT	–	S2	–	–	–

(*continued*)

Appendix 2 (*continued*)

Taxon	BSSC 2008[b]	BSSC 1992[c]	BSSC 1978[d]	T & E[e]	Fully Protected[f]	NatureServe[g]	USFWS 2002[h]	Audubon WatchList 2002	IUCN 2006[j]
Black-tailed Gnatcatcher (*Polioptila melanura*)	–	–	2	–	–	–	–	–	–
Wrentit	–	–	–	–	–	–	–	Y	–
Bendire's Thrasher	3	x	3	–	–	S3	33	R	VU
California Thrasher	–	–	–	–	–	S?	–	Y	–
Crissal Thrasher	3	x	3	–	–	S3	R, 33	–	–
Le Conte's Thrasher	–	x	3	–	–	S3	R, 33	Y	–
Le Conte's Thrasher (San Joaquin population)	1	–	–	–	–	–	32	–	–
Virginia's Warbler (*Vermivora virginiae*)	–	x	3	–	–	S2S3	9	Y	–
Lucy's Warbler	3	–	–	–	–	S2S3	–	Y	–
Yellow Warbler	–	x	2	–	–	S2	–	–	–
Yellow Warbler (*Dendroica petechia morcomi* [including subsumed *brewsteri*])	2	–	–	–	–	–	–	–	–
Sonora Yellow Warbler	2	–	–	–	–	S1	33	–	–
Hermit Warbler	–	–	–	–	–	S3?	–	Y	–
San Francisco Common Yellowthroat	3	x	–	–	–	S2	32	–	–
Yellow-breasted Chat	3	x	2	–	–	S3	–	–	–
Hepatic Tanager (*Piranga flava*)	–	x	3	–	–	S1	–	–	–
Summer Tanager	1	x	2	–	–	S2	–	–	–
San Clemente Spotted Towhee	1	x	–	–	–	S1	32	–	–
Inyo California Towhee	–	–	–	SE, FT	–	S1	–	–	–
Abert's Towhee (*Pipilo aberti*)	–	–	–	–	–	S2?	–	Y	–
Southern California Rufous-crowned Sparrow (*Aimophila ruficeps canescens*)	–	x	–	–	–	S2S3	–	–	–
Santa Cruz Island Rufous-crowned Sparrow	2	–	–	–	–	–	–	–	–
Chipping Sparrow (*Spizella passerina*)	–	–	–	–	–	S3S4	–	–	–
Brewer's Sparrow (*Spizella breweri*)	–	–	–	–	–	S3	R, 9	Y	NT
Black-chinned Sparrow	–	–	–	–	–	S3	32, 33	Y	–
Oregon Vesper Sparrow	2	–	–	–	–	–	5	–	–
Lark Sparrow (*Chondestes grammacus*)	–	–	–	–	–	S?	–	–	–
Sage Sparrow	–	–	–	–	–	–	9, 33	–	–
Bell's Sage Sparrow (*Amphispiza belli belli*)	–	x	–	–	–	S2?	–	–	–
San Clemente Sage Sparrow	FNS	–	–	FT	–	S1	–	–	–
Bryant's Savannah Sparrow	3	–	–	–	–	–	–	–	–
Belding's Savannah Sparrow (*Passerculus sandwichensis beldingi*)	–	–	–	SE	–	S3	–	–	–
Large-billed Savannah Sparrow	2	x	–	–	–	S2?	–	–	–
Grasshopper Sparrow	2	–	–	–	–	S2	–	–	–

Song Sparrow ("Modesto" population)	3	–	–	–	–	–	–	–	–
Suisun Song Sparrow	3	x	–	–	–	S2	32	–	–
Samuels Song Sparrow	3	x	–	–	–	S2?	32	–	–
Alameda Song Sparrow	2	x	–	–	–	S2?	32	–	–
Channel Island Song Sparrow	1	–	–	–	–	–	32	–	–
Santa Barbara Song Sparrow	EX	–	–	–	–	–	–	–	–
Gray-headed Junco (*Junco hyemalis caniceps*)	–	x	3	–	–	S1	–	–	–
Northern Cardinal (*Cardinalis cardinalis*)	–	x	3	–	–	S1	–	–	–
Kern Red-winged Blackbird	2	–	–	–	–	–	–	–	–
Tricolored Blackbird	1	x	–	–	–	S2	R, 9, 15, 32, 33	Y	EN
Yellow-headed Blackbird	3	–	–	–	–	S3S4	–	–	–
Cassin's Finch (*Carpodacus cassinii*)	–	–	–	–	–	–	–	–	NT
Lawrence's Goldfinch	–	–	–	–	–	S3	R, 32, 33	R	–

[a]Conservation status designations are provided for comparison of widely cited assessments at various scales, regional to global. Although not exhaustive, this comparison provides a framework for evaluation of the current status rankings of California's Bird Species of Special Concern (BSSC). Taxa included on other lists are not included here if they occur in California (or the California portion of a relevant BCR) only as vagrants or rare migrants or visitors, unless they formerly were much more numerous in the state and have been greatly reduced in numbers by human activities (e.g., Short-tailed Albatross). For some taxa, rankings may apply to different seasonal or breeding roles on different lists.

[b]Species, subspecies, and distinct populations on the current list of BSSC in California (Table 1). Numbered designations indicate priority levels within the list (1, 2, or 3; highest to lowest). FNS, listed as federally, but not state, threatened or endangered; EX, taxon extirpated from the state totally or in its primary seasonal or breeding role but never listed as state threatened or endangered.

[c]x, species or subspecies on the 1992 unprioritized list of BSSC in California (CDFG 1992).

[d]Species or subspecies on the 1978 list of BSSC in California (Remsen 1978). 1, "highest priority"; 2, "second priority"; and 3, "third priority." Subspecies were considered for inclusion only in the "highest priority" level (Remsen 1978).

[e]Species listed as threatened or endangered by state or federal law. ST, state threatened; SE, state endangered; FT, federally threatened; FE, federally endangered. The federal government no longer maintains a list of Category 1 and Category 2 candidates for consideration for possible addition to the List of Endangered and Threatened Wildlife (USFWS 1996). Taxa are now considered "candidates" only if a proposed listing is likely (equivalent to former Candidate 1 status). Taxa formerly listed as Category 2 candidates (of conservation concern but information not available to support listing) with populations in California are the Reddish Egret, White-faced Ibis, Fulvous Whistling-Duck (SW U.S. population), Ferruginous Hawk, Columbian Sharp-tailed Grouse, Mountain Plover, Elegant Tern, Long-billed Curlew, Spotted Owl, San Francisco (Salt Marsh) Common Yellowthroat, Large-billed Savannah Sparrow, Suisun Song Sparrow, Samuels (San Pablo) Song Sparrow, Alameda Song Sparrow, and Tricolored Blackbird. Several other former Category 2 taxa have been listed, and one former Category 1 taxon (the California Black Rail) has not been federally listed. See footnote [h] below for current USFWS designations for species of conservation concern at the federal level.

[f]x, species listed by California state law as "fully protected" (www.dfg.ca.gov/wildlife/species/t_e_spp/fully_pro.html).

[g]NatureServe Conservation Status (formally Natural Heritage) rankings at the S (subnational) level for California (see NatureServe 2006 for expanded definitions). Rankings for California are assigned by California Department of Fish and Game and tracked by their California Natural Diversity Database. Updated regularly, the ranks used here are from a list dated February 2006 downloaded on 7 January 2007 (www.dfg.ca.gov/whdab/pdfs/SPAnimals.pdf). S1, critically imperiled; S2, imperiled; S3, vulnerable to extirpation or extinction; ?, inexact or uncertain rank; SH, possibly extirpated; SX, presumed extirpated. Numeric range ranks (e.g., S2S3) indicate a range of uncertainty as to exact status. Ranks for populations that are "apparently secure" (S4) and "demonstrably widespread, abundant, and secure" (S5) are not reported here unless part of an uncertainty ranking (e.g., S3S4).

[h]Species or subspecies on the USFWS list of Birds of Conservation Concern 2002 (USFWS 2002), a revision of prior lists (USFWS 1987, 1995); includes taxa of lesser concern than those listed as federally threatened or endangered (see footnote [e] above). R, USFWS Region 1 (states of CA, HI, ID, NV, OR, and WA, plus other Pacific islands). Numbers refer to Bird Conservation Regions (BCRs) including at least part of California: 5, Northern Pacific Rainforest; 9, Great Basin; 15, Sierra Nevada; 32, Coastal California; 33, Sonoran and Mojave Deserts (Figure 1).

[i]The Audubon WatchList priority categories (www.audubon.org/bird/watch/): RED (R), species identified by BirdLife International as Threatened or Near-threatened at the global level and all species identified by Partners In Flight (PIF) as extremely high priority at the national level; YELLOW (Y), the remaining species identified by PIF as of moderately high priority or moderate priority at the national level. The 2002 WatchList and the 1996 WatchList (Carter et al. 1996) are preceded by several Audubon Blue Lists (Tate 1981, Tate and Tate 1982, Tate 1986).

[j]California species with IUCN Red List global conservation status ranks (listed here in descending order of conservation concern): CR, critically endangered; EN, endangered; VU, vulnerable; and NT, near threatened (IUCN 2006).